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Cover. Adult Houston toad (*Bufo houstonensis*), an endangered species. (Photo courtesy of R. A. Thomas)

CONSERVATION OF THE AMPHIBIA OF THE UNITED STATES: A REVIEW

By R. Bruce Bury
C. Kenneth Dodd, Jr.
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Abstract

The conservation status of 39 species and subspecies of amphibians is assessed. Included are 6 forms that are recognized by the Federal Government as Threatened or Endangered Species, and 33 others whose survival has been considered in jeopardy by us or by other persons. Some of these 33 merit special protection, but others apparently are in no immediate danger of extinction. The continued survival of most of the amphibians we discuss can be ensured if their presence in isolated areas becomes better known, management of their habitat is improved, and local and regional protection is increased. This review is based on the literature, personal communications from numerous scientists, and our own field work. For each amphibian, we provide a brief description, geographic range with accompanying map, habitat, status, and recommendations that we believe are needed to protect the animal.

Amphibians are generally harmless denizens of habitats ranging from seeps to lakes and from deserts to swamps. Many are brightly colored and attractive, and have remarkable morphological and ecological adaptations. The animals may be locally abundant. Their role in ecosystems is not well understood, but since they consume large quantities of insects and other invertebrates, they are probably important components of community food webs. In turn, amphibians are fed upon by many of the larger predators (e.g., herons and river otters) and game fishes (e.g., bass and trout). They are an integral part of our wildlife resources.

Amphibians are widely used for scientific research in studies of morphological and ecological adaptations, competition, regeneration of body parts, antibacterial properties, toxins, and many other topics. Several species are also subjects for studies of genetics, embryology, and medicine in the classroom and laboratory.

The amphibian fauna of the United States is rich and diverse, including about 110 species (81 subspecies) of salamanders and 81 species (44 subspecies) of frogs. There are many endemic and relict species. Some frogs, toads, and salamanders live only in underground caves, in limited areas on mountaintops, or in desert springs and seeps. Most of these forms were isolated as the cooler climatic zone shifted northward at the end of the last Ice Age. Other amphibians are mostly tropical in distribution and occur only in the extreme southern United States.

The activities of man are often in conflict with the survival of a number of our native amphibians, and conservation actions to protect amphibians have seriously lagged behind those for other U.S. wildlife.

Some of the forms are on the verge of extinction, but most, if not all, can be adequately protected if actions are undertaken in their behalf in the near future.

Protection of our native fauna has greatly increased over the last decade. California has instituted a nongame conservation program that has led to increased protection for all of the State's rare and endangered amphibians and has included the establishment of two ecological reserves for salamanders (Bury 1975). Colorado, Florida, Maryland, Missouri, New York, Washington, and other States have endangered species programs, and many States are becoming increasingly involved in management of their native herpetofauna, often with financial assistance available through Cooperative Agreements with the U.S. Fish and Wildlife Service. The U.S. Endangered Species Act of 1973 provides wide authority for protection of our native fauna and flora, and Dodd (1976, 1978) has shown how this Act may be applied to the protection of amphibians and reptiles. Ashton (1976) compiled a listing of threatened amphibians and reptiles by States in the United States. A comparison of several types of classification of threatened U.S. amphibians is given in Table 1. Several conservation groups and professional herpetological societies in North America are interested in the protection of amphibians and are working with State and Federal agencies on several problems. Overall, there is now an increasing effort toward protection and management of nongame wildlife, and there is reason for optimism that it will be provided.

Many species, however, remain in a critical situation or are inadequately protected. Only five amphibians occurring in the United States are now officially recognized by the U.S. Department of the Interior (USDI) as "endangered"—in danger of extinction throughout all or a significant portion of their range (Table 1): desert slender salamander, Santa Cruz long-toed salamander, Texas blind salamander, Houston toad, and the Florida populations of the Pine Barrens treefrog. The Red Hills salamander was the first amphibian to be officially designated by the USDI as "Threatened"—a species which is likely to become an endangered species within the foreseeable future. The addition of the black toad and San Marcos salamander to this category has also been proposed. Dodd (1979) has compiled a bibliographic reference on the literature dealing with these species.

On 2 August 1977, the U.S. Fish and Wildlife Service initiated a review of the status of 10 amphibians, of which 9 are included herein (Table 1): *Bufo nelsoni, Hyla andersonii* (New Jersey, North Carolina, South Carolina), *Rana onca, Necturus lewisi, Eurycea nana, E. troglodytes, E. tridentifera, Plethodon larselli,* and *P. stormi.* The omitted form is the Puerto Rican toad (*Bufo lemur*).

We have not examined the status of certain U.S. amphibians. Some of these are species that have their northernmost range limit in the United States—particularly in Texas, Arizona, and New Mexico—and have a more extensive range farther southward. In this group are 10 frogs: the hylids *Osteopilus septentrionalis, Smilisca baudini,* and *Pternohyla fodiens;* the leptodactylids *Syrrhophus cystignathoides, S. guttilatus, Leptodactylus labialis, Hylactophryne augusti,* and *Eleutherodactylus planirostris;* the microhylid *Hypopachus variolosus;* and the Rhinophrynid *Rhinophrynus dorsalis.* Neither have we treated several "species" which recent studies indicate are merely isolated populations of wide-ranging species. Two of these forms are *Plethodon longicrus* (=*Plethodon yonahlossee)* in North Carolina and *Rana maslini* (=*Rana sylvatica)* in Colorado and Wyoming. Also, we have excluded four species that have been recently described: a brook salamander (*Eurycea junaluska*) from North Carolina (Sever et al. 1976); a slender salamander (*Batrachoseps campi*) from California (Marlow et al. 1979); a spring salamander (*Gyrinophilus subterraneus*) from a cave in West Virginia (Besharse and Holsinger 1977); and a new subspecies of waterdog (*Necturus maculosus*) from Alabama (Mount 1976). Although all of these apparently are restricted in range, more information is required before comment can be made on their status. We exclude the Alaska slender salamander (*Batrachoseps caudatus*) because no specimens have been found since its description about 90 years ago and its validity is suspect (Brame and Murray 1968; Hodge 1976).

The conservation status of the amphibians of the United States is poorly known and needs to be critically evaluated. Toward this goal, we here assess amphibian populations on the basis of a review of the literature, on our field experience with almost all species and habitats that are discussed, and on new information on several forms received as personal communications from colleagues. We have also attempted to point out field surveys and studies that are needed to adequately determine population status and trends, impacts of environmental degradation or habitat alteration, and effects of collecting.

Our review includes information on the 6 Endangered and Threatened amphibians on the USDI list, plus 33 others which we selected as in need of assessment (Table 1). This is a conservative selection, including only 16% of the salamanders (species and subspecies) and 7% of the frogs and toads in the United States.

This report identifies both the species and subspecies that we think are threatened and those considered to be threatened by other people but thought by us to be in satisfactory condition at this time. The gen-

Table 1. *Status of species of amphibians: International Union for Conservation of Nature (IUCN), Federal List of Endangered and Threatened Wildlife and Plants (USDI), Society for the Study of Amphibians and Reptiles (SSAR;* in *Ashton 1976) and present study.* Abbreviations: D = Discussed in this volume; E = Endangered; I = Indeterminate; PT = Proposed Threatened; R = Rare; T = Threatened; UR = Under Review; V = Vulnerable; X = Listed as rare, threatened or endangered in at least one State (SSAR list).

Species	Distribution	IUCN	USDI	SSAR	Present study
Bufo exsul, black toad	CA	V	PT	E	D
Bufo houstonensis, Houston toad	TX	E	E	X	D
Bufo nelsoni, Amargosa toad	NV	I	UR		D
Bufo retiformis, Sonora green toad	AZ	V			D
Hyla andersonii, Pine Barrens treefrog	NJ,NC,SC,FL,GA	R	E(FL), UR(SC,NC,NJ)	T(NJ), E(SC, NC,FL)	D
Hyla wrightorum, Arizona treefrog	AZ			E	
Hylactophryne augusti latrans, eastern barking frog	NM			E	
Pseudacris streckeri illinoensis, Illinois chorus frog	IL,MO,AR	I		X	D
Rana areolata aesopus, Florida gopher frog	FL,GA			T(FL,GA)	D
Rana onca, relict leopard frog	NV,UT,AZ	E	UR	X	D
Rana tarahumarae, Tarahumara frog	AZ			T	D
Cryptobranchus a. alleganiensis, hellbender	Eastern U.S.			X	D
Amphiuma pholeter, one-toed amphiuma	FL,GA			T	D
Pseudobranchus striatus lustricolus, Gulf Hammock dwarf siren	FL			T	D
Siren intermedia texana, Rio Grande lesser siren	TX				D
Notophthalmus perstriatus, striped newt	FL,GA			T(FL)	D
Necturus lewisi, Neuse River waterdog	NC		UR	T	D
Ambystoma cingulatum, flatwoods salamander	SC,GA,FL,AL			X	D
Ambystoma macrodactylum croceum, Santa Cruz long-toed salamander	CA	E	E	E	D
Ambystoma tigrinum californiense, California tiger salamander	CA			T	
Aneides hardii, Sacramento Mountain salamander	NM			T	D
Batrachoseps aridus, desert slender salamander	CA	E	E	E	D
Batrachoseps simatus, Kern Canyon slender salamander	CA	R		E	D
Batrachoseps stebbinsi, Tehachapi slender salamander	CA	R		E	D
Eurycea aquatica, dark-sided salamander	AL,TN				D
Eurycea latitans, Cascade cave salamander	TX			E	D
Eurycea nana, San Marcos salamander	TX		PT	E	D
Eurycea tridentifera, Comal blind salamander	TX		UR	X	D
Eurycea troglodytes, Valdina Farms salamander	TX		UR	X	D
Eurycea tynerensis, Oklahoma salamander	OK,MO,AR			R(MO),T(OK)	D
Gyrinophilus palleucus, Tennessee cave salamander	TN,AL			R(AL), T(GA,TN)	D
Haideotriton wallacei, Georgia blind salamander	GA,FL			T(FL),E(GA)	D
Hydromantes brunus, limestone salamander	CA	R		E	D

Table 1. Continued.

Species	Distribution	IUCN	USDI	SSAR	Present study
Hydromantes shastae, Shasta salamander	CA	R		T	D
Phaeognathus hubrichti, Red Hills salamander	AL		T	T	D
Plethodon larselli, Larch Mountain salamander	OR,WA	I	UR	T	D
Plethodon neomexicanus, Jemez Mountains salamander	NM	V		E	D
Plethodon n. nettingi, Cheat Mountains salamander	WV			T	D
Plethodon n. hubrichti, Peaks of Otter salamander	VA			X	D
Plethodon n. shenandoah, Shenandoah salamander	VA				D
Plethodon ouachitae, Ouachita salamander	OK			T	
Plethodon stormi, Siskiyou Mountains salamander	CA,OR		UR	T	D
Typhlomolge rathbuni, Texas blind salamander	TX	E	E	E	D

eral distribution of these amphibians is shown in Fig. 1.

Many other local problems remain because there are numerous isolated populations of amphibians in North America, many of which will eventually need protection if they are to survive. We point out, however, that there are provisions in the Endangered Species Act of 1973 to protect unique populations that are threatened with extinction. Some of these isolated populations may eventually receive protection under the provisions of this Act or its amendments.

Changes in the List of Endangered and Threatened Wildlife are promulgated by the Office of Endangered Species, U.S. Fish and Wildlife Service. The official U.S. List of Endangered and Threatened Wildlife should not be confused with our evaluations. We are concerned with the summation of biological information on selected amphibians and offer recommendations for use and comment. We mean to alert individuals and various agencies to special problems about certain native amphibians that we think merit careful monitoring and special attention.

We recommend identification of the habitats of the forms discussed here, and their protection on both public and private lands. Most of the forms that we discuss occur in habitats that are unique, unusual, or relictual. Federal, State, and local action is vital to the protection of nearly all of them. A concerted conservation effort will help these amphibians survive in an increasingly human-dominated continent.

Habitat preservation is the key to the protection of our native amphibians. Scientific take normally has little or no adverse effects on populations, but collecting for commercial purposes remains a threat to certain species occurring in isolated habitats. Our greatest need is for intensive field surveys to delineate the occurrence, abundance, and habitat requirements of U.S. amphibians considered as endangered, threatened, or of special concern.

Species Accounts

Black Toad (*Bufo exsul*)

Description

A small toad usually less than 7 cm long. Dorsally it is dark black with a narrow middorsal stripe. The ventral side is light with black mottling.

Range

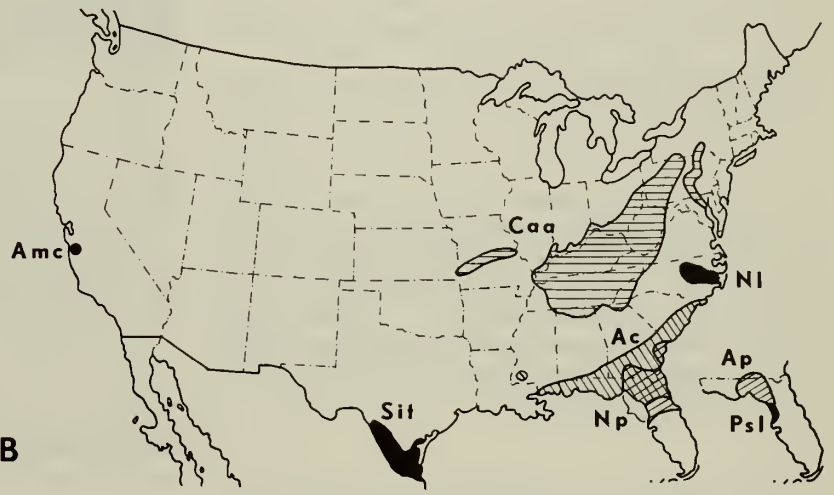
Known from two localities: Antelope Springs and Deep Springs (=Buckhorn Springs), in the southwestern part of Deep Springs Valley, Inyo County, California (Fig. 2).

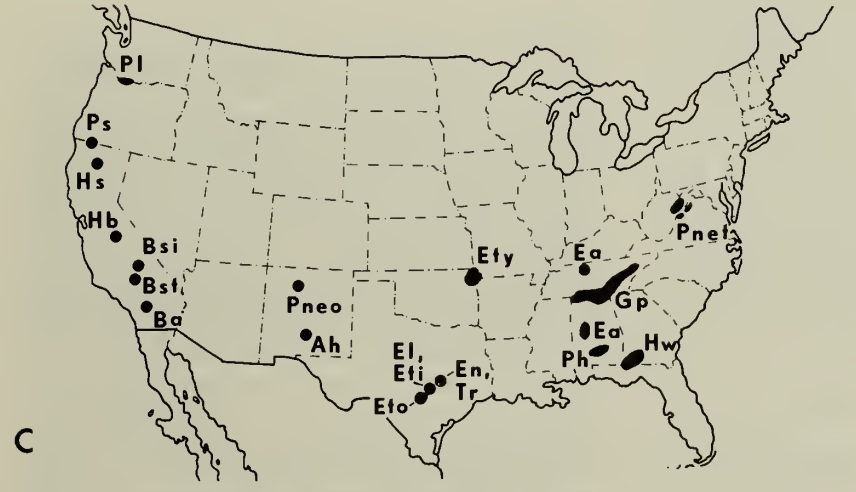
Habitat

"Like other desert valleys to the east of the Sierra Nevada, Deep Springs is exceedingly dry, and on its floor the vegetation consists of sparse low desert brush (*Chrysothamnus*). The surrounding mountains support growths of juniper and piñon. The valley has few sources of water .... The chief water source is formed by Buckhorn or Deep Springs which flow from

A. Frogs and Toads
Be = *Bufo exsul*
Bh = *B. houstonensis*
Bn = *B. nelsoni*
Br = *B. retiformis*
Han = *Hyla andersonii*
Psi = *Pseudacris streckeri illinoensis*
Raa = *Rana areolata aesopus*
Ro = *R. onca*
Rt = *R. tarahumarae*

B. Salamanders other than plethodontids
Ac = *Ambystoma cingulatum*
Amc = *A. macrodactylum croceum*
Ap = *Amphium pholeter*
Caa = *Cryptobranchus alleganiensis alleganiensis*
Nl = *Necturus lewisi*
Np = *Notophthalmus perstriatus*
Psl = *Pseudobranchus striatus lustricolus*
Sit = *Siren intermedia texana*





C. Plethodontid (lungless) salamanders
Ah = *Aneides hardii*
Ba = *Batrachoseps aridus*
Bsi = *B. simatus*
Bst = *B. stebbinsi*
Ea = *Eurycea aquatica*
El = *E. latitans*
En = *E. nana*
Eti = *E. tridentifera*
Eto = *E. troglodytes*
Ety = *E. tynerensis*
Gp = *Gyrinophilus palleucus*
Hb = *Hydromantes brunus*
Hs = *H. shastae*
Hw = *Haideotriton wallacei*
Ph = *Phaeognathus hubrichti*
Pl = *Plethodon larselli*
Pneo = *P. neomexicanus*
Pnet = *P. nettingi* (three subspecies)
Ps = *P. stormi*
Tr = *Typhlomolge rathbuni*

Fig. 1. Distribution of 39 threatened or endangered amphibians.

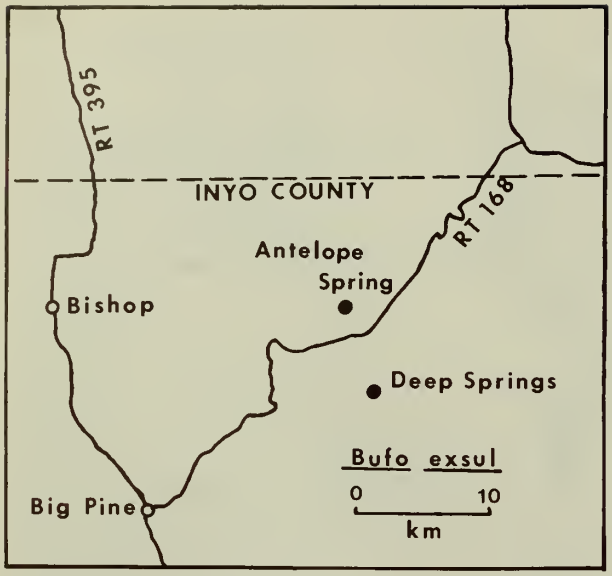


Fig. 2. Distribution of the black toad is limited to two localities in eastern California.

the base of the southeastern valley wall just above the sink. These springs issue from the rocks for a distance of a mile or more, but only a few of them have a strong flow. The flow from the more southerly springs forms a marshy area of several acres . . ." (Myers 1942). Schuierer (1961) indicated that the toads breed mostly in the shallow marsh waters near Deep Springs, which cover an area of about 0.9 ha.

Status

The restricted range of this unique amphibian makes it highly susceptible to alterations of its habitat. The population was estimated to have 10,000 adults in 1954 (Schuierer 1961), and now seems to be maintaining itself (Schuierer 1972). Livestock grazing at the springs and canals is a potential problem for the toads (Busack and Bury 1975). Adults may be detrimentally affected by periodic burning of the marsh, and by channel and ditch alterations. The black toad is protected by the State of California against collection, possession, and sale (California Fish and Game 1978). It was recently proposed as a Threatened species for inclusion on the U.S. List of Endangered and Threatened Wildlife.

Recommendations

- The two springs that have known populations should be managed to maintain as much natural habitat as possible.
- Introduction of bullfrogs (*Rana catesbeiana*) and other introduced predators should be controlled.
- Livestock should be fenced from areas used by the toads.
- A formal agreement should be initiated between the State of California or Federal Government and Deep Springs College to protect the toad and its habitat.
- Marsh burning and channel modifications should be discontinued.

Houston Toad (*Bufo houstonensis*)

Description

A small toad, similar to the American toad (*Bufo americanus*), but with heavier cranial crests, especially behind the eyes. The back has a brown to black mottled pattern on a cream background. A light middorsal stripe is usually present. The back is very warty. The ventor has numerous small, dark spots (Brown 1973).

Range

Known only from relict populations in Bastrop, Burleson, and Harris counties in Central Texas (Fig. 3). Of these, the population in Bastrop County appears to be the largest; that in Burleson County is small but stable. Although this species was believed to be extirpated in Harris County, it is now known from several localities in southern Houston (R. Thomas, personal communication).

Habitat

The Houston toad is limited to sandy or sandy loam soil and is often associated with loblolly pine, *Pinus taeda* (Brown 1971, 1973).

Status

Populations at most of the localities appear to be relatively small, except that in Bastrop County. There, in Buescher State Park, the population seems to be maintaining its viability. Although Brown (1975) felt that the species was probably extinct or effectively extinct because its numbers were so small at most localities, new evidence (R. Thomas, personal communication) indicated that this may not be true. However, lumbering, road building, and urbanization are continuing to reduce much favorable habitat and are the main threats to the continued survival of this species. Hybridization with other toads (*Bufo woodhousei* and *B. valliceps*) may follow habitat disturbance, and this hybridization appears to be genetically changing Houston toad populations in some areas (W. McClure, personal communication). Furthermore, *B. woodhousei* and *B. valliceps* appear to cope with habitat destruction better than does *B. houstonensis*.

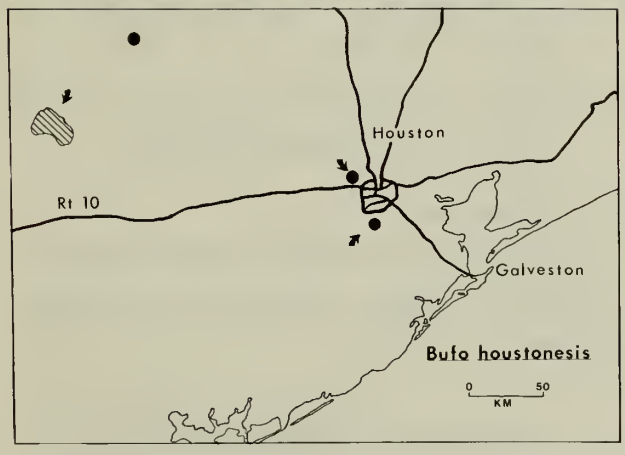


Fig. 3. Singing male of the Houston toad and its distribution in southern Texas. (Photo by R. A. Thomas)

This species is listed as Endangered by the USDI (1973) and its Critical Habitat has been determined for the populations in Bastrop and Burleson counties. This species is also classified as a "Protected Species" by the State of Texas. An Endangered Species Recovery Team is established to oversee the continued survival of the Houston toad and a captive rearing program has been initiated with the Houston Zoo.

Recommendations

- Remaining habitat, especially the areas containing breeding sites, should be purchased by private, State, or Federal agencies as preserves for this species.
- A captive breeding program and releases into protected sites should be continued as a means of propagating this species at selected sites.
- The status of the remaining populations of this species should be continually monitored.

Amargosa Toad (*Bufo nelsoni*)

Description

A small toad similar to, but about half the size of, the western toad (*Bufo boreas*). Some authorities consider the Amargosa toad as a subspecies of the western toad. It has a strikingly wedge-shaped snout when viewed from below and has small feet with reduced webbing. The color is buffy olive with a yellow to buff stripe down the mid-back. The skin is smooth and the warts are small and weakly developed (Linsdale 1940).

Range

Occurs in three rather widely separated localities in southern Nevada: Oasis Valley and Hot Creek Valley in Nye County, and Pahranagat Valley in Lincoln County (Fig. 4). Wright and Wright (1949) reported it at Resting Springs and Owen's Valley, Inyo County, California, but no recent records are available for California.

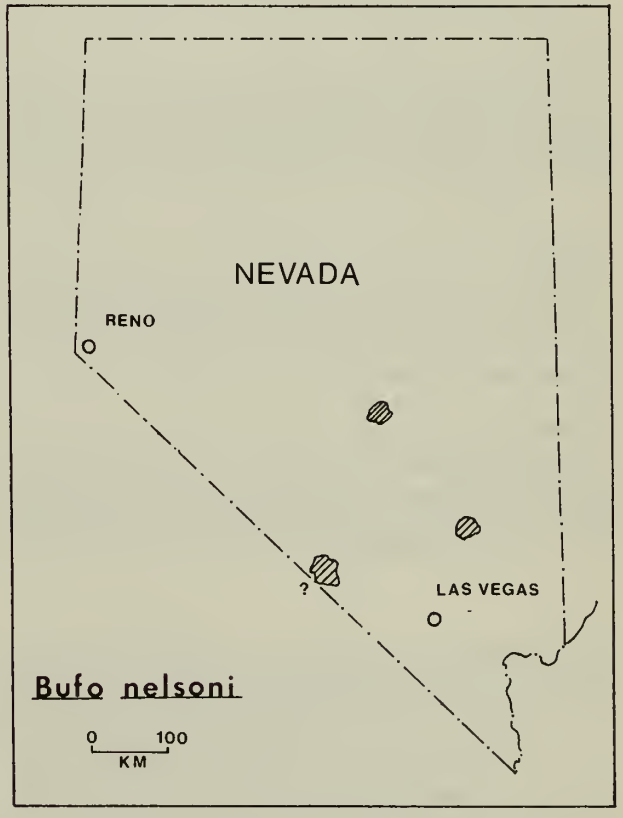


Fig. 4. Distribution of the Amargosa toad.

Habitat

Frequents freshwater areas (marshes and along rivers) in an otherwise arid region. Like the black toad, the Amargosa toad appears to be relatively aquatic.

Status

The sizes of individuals in the various populations of this toad are unknown. R. C. Stebbins (in IUCN 1975) indicated that increasing demands for water for irrigation and the use of pesticides are contributing to a significant decline in the numbers of this toad. The population north of Beatty, Nevada, could also be seriously affected if U.S. Highway 95 is widened.

Recommendations

- A survey of the existing populations of toads should be undertaken to assess their status.
- Pesticide use should be restricted in regions where the toads occur, especially near marshes and other breeding areas.
- Pumping of groundwater and channelization should be restricted in the vicinity of toad habitat.

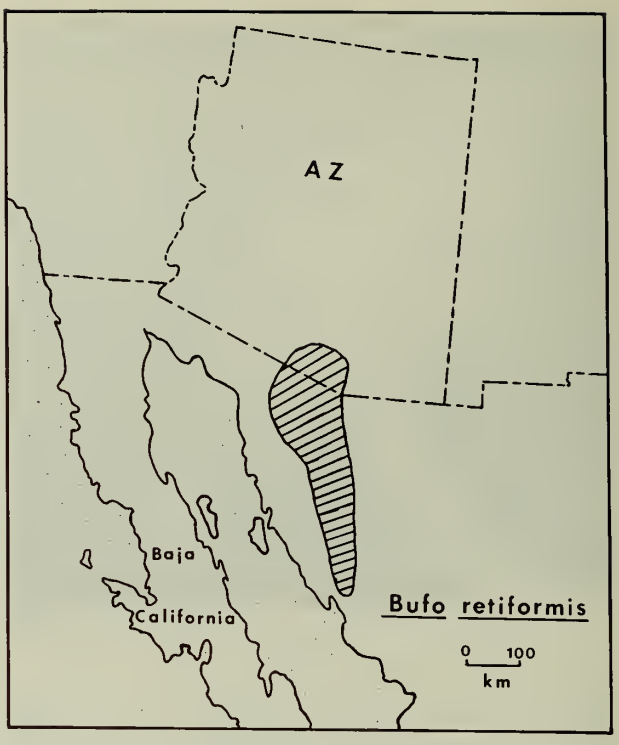


Fig. 5. Range of the Sonoran green toad.

Sonora Green Toad (*Bufo retiformis*)

Description

A vividly marked, small, greenish-yellow toad whose bright dorsal color is set off by a network of black. It is similar to the green toad (*Bufo debilis*), but has larger parotoid glands.

Range

This form is known to occur in the United States only in Pima and Pinal counties, Arizona (Nickerson and Mays 1968). It ranges southward into west central Sonora, Mexico (Fig. 5).

Habitat

The Sonora green toad occurs in arid and semiarid plains with mesquite, creosote bush, and bunchgrass; breeding occurs in areas of permanent and temporary fresh water (USDI 1973).

Status

The status of this secretive nocturnal toad is largely unknown, but R. C. Stebbins (in IUCN 1975) listed overcollecting as being the chief threat to this species. Ashton (1976) reported that the Arizona populations are stable. Hulse (1978) indicated that well drilling and irrigation may be making more suitable habitat for *B. retiformis* near Hermosillo, Sonora, and in southern Pinal County, Arizona.

Recommendations

- A survey should be taken to assess the status of this species.
- Collecting should be allowed only for scientific purposes.

Pine Barrens Treefrog (*Hyla andersonii*)

Description

A small green treefrog with a light-bordered lavender stripe along the side of the body and a small dark eye mask. The legs have bright yellow-orange markings, which are concealed when the animal is in the normal sitting position.

The Florida populations of this treefrog differ from the more northern populations in their mating call and in body proportions (Means and Longden 1976).

Range

The species is known to occur in three disjunct areas: the Pine Barrens of New Jersey, the upper Coastal Plain of North and South Carolina, and northwestern Florida (Fig. 6). Questionable reports indicate that it may also occur in Richmond County, Georgia, and Delaware County, Pennsylvania (Gosner and Black 1967). A small population was known from Walton

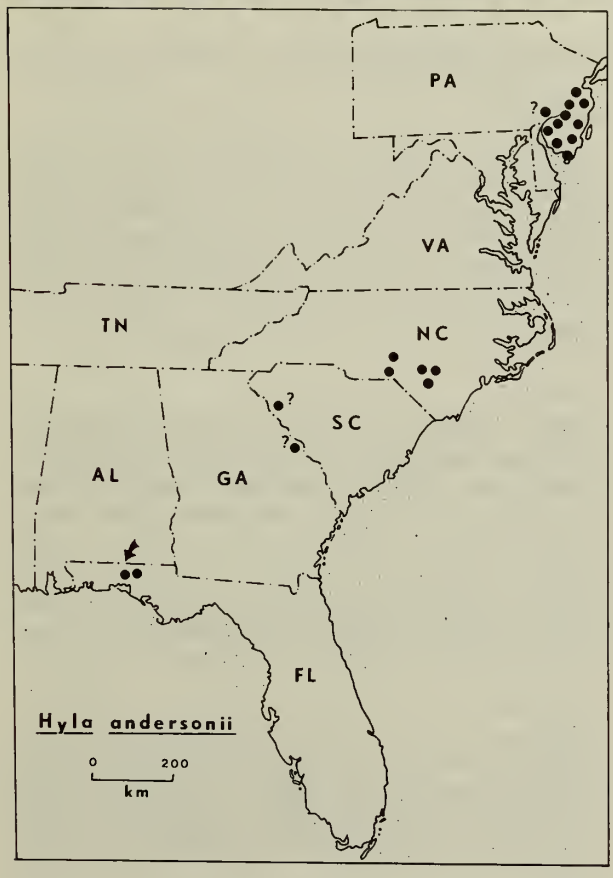


Fig. 6. Adult Pine Barrens treefrog and its disjunct distribution in the eastern United States. (Photo by D. B. Means)

County, Florida, but it was apparently extirpated (D. Means, personal communication). However, recent studies have revealed several new populations in the Florida panhandle (P. E. Moler, personal communication). H. W. Campbell (personal communication) suggested that a search for this frog in the Dismal Swamp region of Virginia and North Carolina might reveal additional populations.

Florida: Okaloosa, Santa Rosa, and Walton counties.

New Jersey: Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Middlesex, Monmouth, Ocean, and Salem counties.

North Carolina: Bladen, Cumberland, Duplin, Harnett, Hoke, Johnston, Jones, Lee, Lenoir, Moore, Onslow, Pender, Richmond, Sampson, Scotland, and Wayne counties.

South Carolina: Chesterfield County.

Habitat

In North Carolina, the Pine Barrens treefrog has been found in low bays and upland swamps of the Coastal Plain. The New Jersey populations are restricted to bogs and swamps of the Pine Barrens (Wright and Wright 1949). In Florida, it prefers seepage areas and shrub bogs (Means and Longden 1976; Means 1978*a*).

Status

The Pine Barrens treefrog is fairly common within areas of suitable habitat, especially in the more northerly part of its range (New Jersey, North Carolina, South Carolina). However, it is locally threatened by rapid development of housing and industry. Manipulation of the water table for recreational purposes may have a deleterious effect on the species. This frog is limited to sandy, pine areas, but is now known to occur over a large area. Thus, it appears less threatened with extinction than formerly thought (USDI 1973).

Habitat of the Florida populations requires protection. Of the 11 populations known when the species was first reported from Florida (Christman 1970), 4 have been extirpated (Means and Longden 1976; D. Means, personal communication).

The Pine Barrens treefrog is listed as threatened by New Jersey and North Carolina, and endangered by Florida and Georgia. Most of the known South Carolina localities are on the Carolina Sandhills National Wildlife Refuge. The Florida populations of this species are listed as Endangered on the U.S. List of Endangered and Threatened Wildlife.

Recommendations

- A major portion of the New Jersey Pine Barrens should be protected or managed for wildlife, not only for the Pine Barrens treefrog, but also to save part of this biologically unique region.
- The water table of the Pine Barrens should not be altered for recreational or other purposes.
- A survey should be taken to determine the status of the New Jersey, North Carolina, and South Carolina

populations.

• Known areas supporting populations of this frog in Florida should be immediately acquired.

Illinois Chorus Frog (*Pseudacris streckeri illinoensis*)

Description

A medium-sized hylid frog with a toad-like appearance. It has a lateral stripe from snout to shoulder, a light upper jaw, and a dark V- or Y-shaped mark between the eyes. The ground color is tan, flesh color, green, or light bronze; markings are light to chestnut brown or black (Smith 1961, 1966).

Range

Known from Alexander, Cass, Mason, Morgan, and Tazewell counties, Illinois; Clay County, Arkansas; and Cape Girardeau, Dunklin, Mississippi, New Madrid, Pemiscot, Scott, and Stoddard counties, Missouri (Fig. 7).

Habitat

Found in regions of sand prairie (Smith 1966), an area of low grassy vegetation within which there are scattered trees and shrubs. It is also known from one locality in the Austroriparian Biotic Province (Holman et al. 1964).

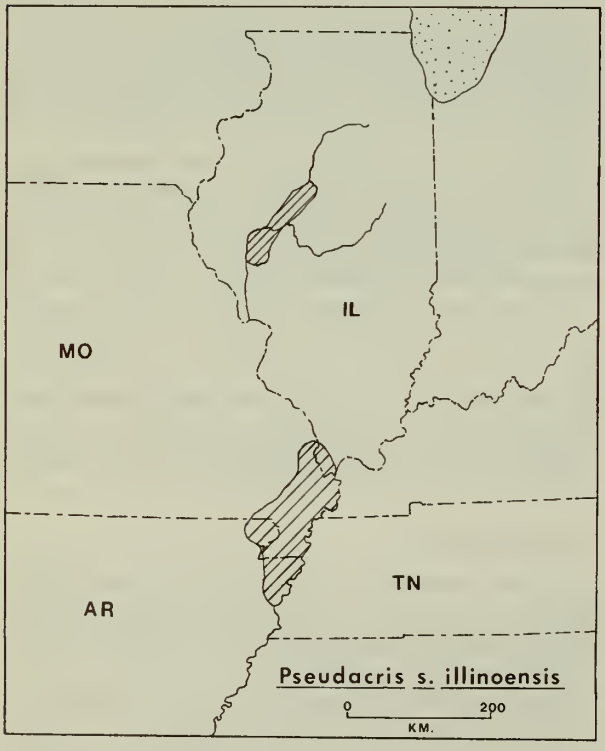


Fig. 7. Range of the Illinois chorus frog.

Status

Its status is unknown, although it appears to be locally abundant in remaining sand prairie habitats. It is not known whether this subspecies is actually declining. Agricultural use is reportedly destroying parts of its habitat (Ashton 1976).

Recommendation

• A survey should be undertaken to assess the status of this species.

Florida Crawfish Frog (*Rana areolata aesopus*)

Description

The ground color varies from cream to brown through various shades of yellow and purple. It has black or brown markings that are irregular in shape and not encircled by light borders. The belly is usually unmarked toward the rear, although the chin and throat are spotted. The maximum length is about 10 cm.

Range

This form occurs from south-central Georgia south to the northern half of the Florida peninsula (Fig. 8). Known from Alachua, Brevard, Broward, Citrus, Collier, Duval, Hernando, Highlands, Hillsborough, Indian River, Lake, Leon, Levy, Manatee, Marion, Nassau, Okeechobee, Orange, Osceola, Palm Beach, Pinellas, Polk, Putnam, Sarasota, Seminole, Sumter, Taylor, Volusia, and Wakulla counties. Specific locality records are not available for Georgia.

Habitat

This frog seems to prefer burrows of the Gopher tortoise (*Gopherus polyphemus*) or crayfish, where it spends much of the day. It is found in areas of high pine, blackjack oak, turkey oak, and sand pine scrub.

Status

Overcollecting and the destruction of habitat are the main factors affecting this species (Ashton 1976; Fogarty 1978). Considered a "Threatened" species by the Florida Audubon Society and Florida Defenders of the Environment (Fogarty 1978).

Recommendations

• A field survey is needed to assess the distribution of this subspecies.

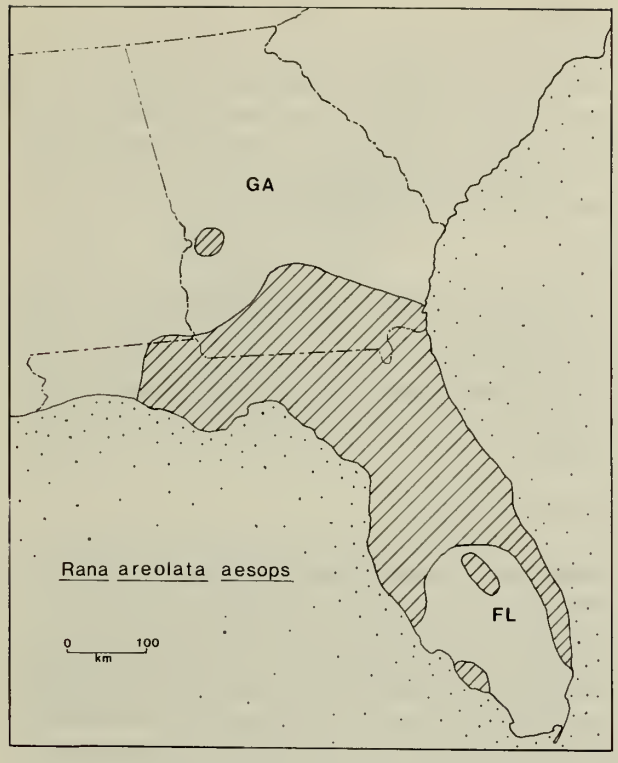


Fig. 8. Distribution of the Florida crawfish frog.

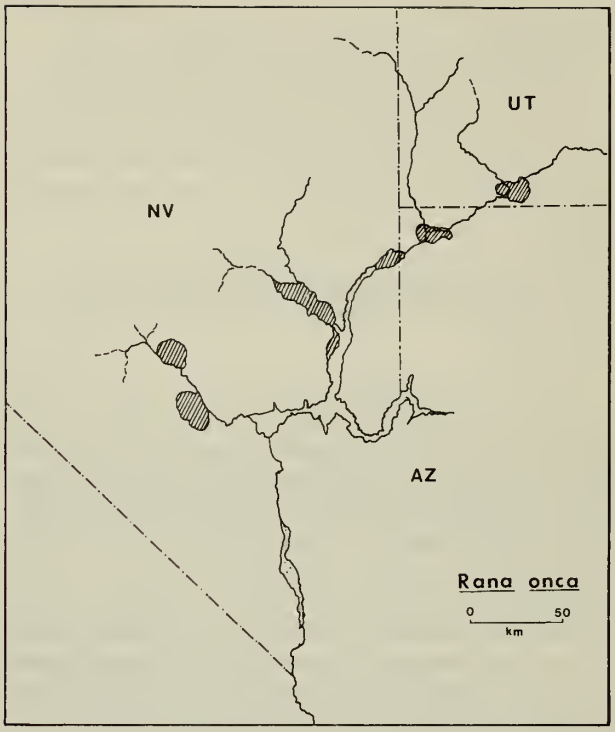


Fig. 9. Range of the Relict leopard frog.

• The status of the related dusky gopher frog (*R. a. sevosa*) also should be assessed. This form occurs from western Florida to extreme eastern Louisiana; it is a "Rare" subspecies in Alabama (Mount 1976).

Relict Leopard Frog (*Rana onca*)

Description

"A medium-sized frog, resembling the common leopard frog, but without a white line on the upper jaw; dorsum unspotted or with numerous small spots; yellow on under parts" (USDI 1973). The dorsal spots, if present, are usually small and faint without sharp outline.

Range

Originally described as the Vegas Valley leopard frog (*Rana pipiens fisheri*), a form limited to springs in the vicinity of Las Vegas, Clark County, Nevada. However, since Pace (1974) placed *R. p. fisheri* in synonymy with *Rana onca,* the range now includes the vicinity of the Virgin River in Washington County, Utah, and Coconino County, Arizona, as well as Clark County, Nevada (Fig. 9). Platz (1976), in a biochemical study, indicated that *R. onca* might be the same species as the "lowland type" of leopard frog (*R. pipiens* complex) in Arizona.

Habitat

Linsdale (1940) stated that *Rana onca* inhabits streams and springs along the Virgin River. It was formerly known from springs and seepage areas near Las Vegas.

Status

Rana p. fischeri (=R. onca) in the Vegas Valley has been reported as possibly extinct (USDI 1973) or extinct (Opler 1976). Populations of leopard frogs still occur along the Virgin River (J. Johnson, personal communication) and possibly the species is extant outside the Vegas Valley.

Recommendations

• A search should be made for this species, and precise information concerning its present distribution and status should be assembled.

• The taxonomic affinities of *Rana onca* must be clarified—particularly the relationships of the lowland leopard frogs along the Colorado River to other populations.

• If populations are rediscovered in the vicinity of

Las Vegas, they should be protected from habitat destruction.

• Other populations of leopard frogs inhabit restricted springs in desert areas, such as at San Felipe Creek, Imperial County, California. The systematic and conservation status of these populations should be investigated and efforts for their preservation undertaken.

Tarahumara Frog (*Rana tarahumarae*)

Description

The dorsal region of this frog is rust, olive, or dark brown, with dark spots that often have light centers. The hind legs are prominently banded. The ventral surface is whitish but may be dusky. Generally no eye mask or light jaw stripes are present, and the dorsolateral folds and eardrums are indistinct.

Range

The range includes much of the States of Chihuahua, Sinaloa, and Sonora in Mexico (Fig. 10). In the United States, it is known to occur in Tinaja and Sycamore canyons, and near Pena Blanca Springs and Alamo Spring in southwestern Santa Cruz County, Arizona (Zweifel 1968). Hale et al. (1977) reported new localities in Gardner Canyon, Big Casa Blanca Canyon, and Adobe Canyon in north-central Santa Cruz County.

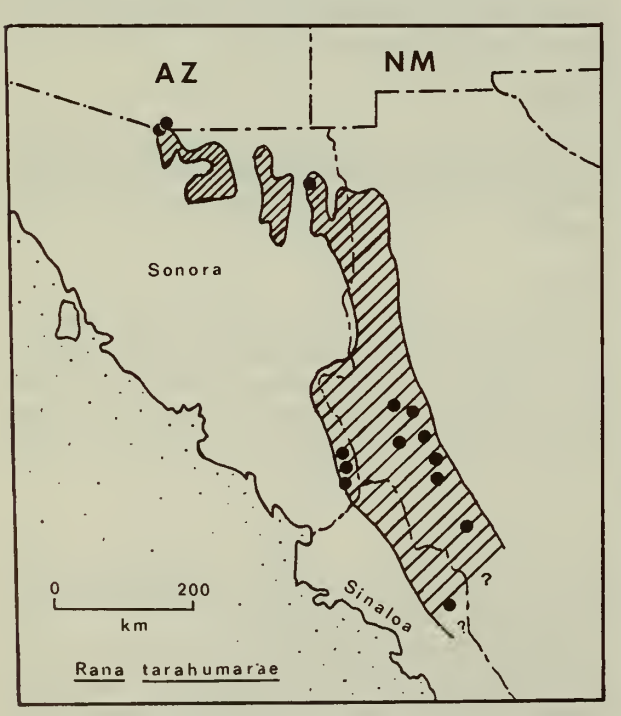


Fig. 10. Range of the Tarahumara frog.

Habitat

This species inhabits "canyon streams (some of which may in the dry season have water only in isolated potholes) at elevations between about 1500 and 6000 ft [450 to 1800 m]. Associated vegetation includes oak woodland, tropical deciduous forest and pine forest" (Zweifel 1968).

Status

The limited distribution of this species in the United States makes it vulnerable to overcollecting and habitat destruction. It is representative of a more southerly fauna and steps should be taken to insure its well-being because the U.S. populations may be in jeopardy.

Recommendations

• A survey of this species should be undertaken to determine its occurrence and status in the United States.

• Habitat destruction, including water pumping, should be minimized in localities where this frog occurs.

• Populations need to be spared from competition and predation by introduced bullfrogs (*Rana catesbeiana*).

Hellbender (*Cryptobranchus alleganiensis alleganiensis*)

Description

A large aquatic salamander with a flattened head, stocky body with fleshy folds of skin on its sides, a keeled tail, and powerful limbs. The color is usually chocolate brown with darker markings on the dorsum. Adults may reach a total length of 76 cm.

Range

The range of this salamander includes the eastern United States, from southern and western New York south to northern Georgia, Alabama, and northeastern Mississippi, and west to central Missouri (Fig. 11). It may have been extirpated in many areas where it was once common, especially in many of the larger river systems.

The following county records are those of Nickerson and Mays (1973):

Alabama: Lauderdale, Madison, and Morgan, in the Tennessee River drainage.

Georgia: Barrow and Rabun, in the Tennessee and Savannah (?) river drainages.

Illinois: Gallatin, Hardin, Massac, Pulaski, and White, in the Ohio River drainage.

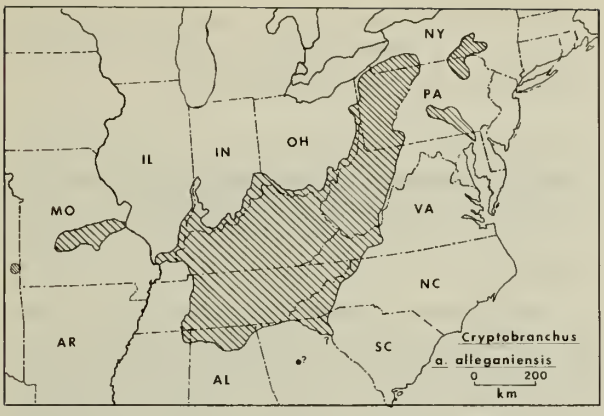


Fig. 11. Occurrence of the hellbender in the United States.

Indiana: Crawford, Floyd, Franklin, Jefferson, Knox, Posey, Switzerland, Vanderburgh, and Vigo, in the Ohio River drainage.

Kansas: Cherokee, in the Neosho River drainage.

Kentucky: Edmonson and Rowan, in the Cumberland, Kentucky, Triplett, and Licking river drainages.

Maryland: Cecil and Garret, in the Susquehanna and Youghiogheny river drainages.

Mississippi: Tishomingo, in the Tennessee River drainage.

Missouri: Camden, Dallas, Dent, Franklin, Jefferson, Phelps, and Texas, in the Missouri and Mississippi river drainages.

North Carolina: Ashe, Buncombe, Cherokee, Madison, Orange (?), Transylvania, and Yancey, in the Tennessee River drainage.

New York: Allegheny, Broome, Cattaraugus, Chenango, and Delaware, in the Allegheny and Susquehanna river drainages.

Ohio: Athens, Mahoning, Scioto, and Washington, in the Ohio River drainage.

Pennsylvania: Allegheny, Beaver, Butler, Crawford, Cumberland, Dauphin, Erie, Greene, Indiana, Lancaster, McKean, Mercer, Mifflin, Perry, Potter, Somerset, Venango, Warren, Westmoreland, Wyoming, and York, in the Susquehanna, Allegheny, Monongahela, Youghiogheny, Conemaugh, Juaniata, and Mahoning river drainages.

South Carolina: Abbeville (?) and Anderson, in the Savannah River drainage.

Tennessee: Davidson, Greene, Hardin, Sevier, and Washington, in the Tennessee and Cumberland river drainages.

Virginia: Floyd, Giles, Grayson, Lee, Montgomery, Pulaski, Russell, Scott, Smyth and Washington, in the Tennessee and New river drainages.

West Virginia: Cabell, Clay, Greenbrier, Kanawha, Marion, Marshall, Monongalia, Monroe, Nicholas, Pocahontas, Randolph, Ritchie, Summers, Tucker, Tyler, Wayne, Webster, and Wyoming, in the Cheat and Ohio river drainages.

Habitat

"Almost always found in rivers and larger streams where water is running and ample shelter is available in the form of large rocks, snags, or debris" (Conant 1975). The water is usually clear, clean, and well oxygenated.

Status

Nickerson and Mays (1973) listed the status of this species as unknown in Georgia, Maryland, North Carolina, New York, South Carolina, and Virginia. It is either extinct or endangered in Illinois and Indiana. The salamander has been eliminated throughout much of its range, including the Ohio and Susquehanna rivers because of industrial pollution and lowered oxygen levels (Dodd 1978).

In Alabama, the channelizing of streams, impoundment of rivers, and pollution have led to the decline in available habitat for Hellbenders. This is apparently also true in Maryland, Missouri, Tennessee, and West Virginia. The proposed Tennessee-Tombigbee Waterway in Mississippi threatens the population in Tishomingo County. Industrialization, agricultural runoff, and mine wastes have contributed to a serious decline in water quality, and thus available habitat, in Ohio, Pennsylvania, and West Virginia (Nickerson and Mays 1973).

Ashton (1976) listed the salamander as endangered in Illinois, Indiana, and Maryland; threatened in Alabama and Arkansas; and rare in Kansas and Ohio.

Possibly the range of this species has declined greatly in many areas. If so, many literature records would not be valid in assessing the status of this species today.

This species is listed as "Rare and Endangered" in Indiana and "Endangered" in Maryland (Committee on Rare and Endangered Amphibians and Reptiles of Maryland 1973).

Recommendations

- A complete survey of the distribution of this species needs to be undertaken.
- The impoundment of rivers and stream channelization should be curtailed where viable populations occur.
- Pollution (industrial, agricultural, mining) should be closely controlled in streams where this salamander occurs.

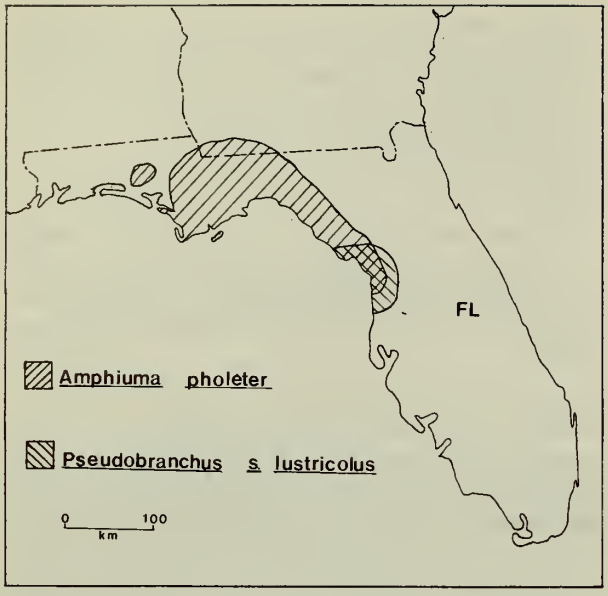


Fig. 12. Distribution of the one-toed amphiuma and the Gulf Hammock dwarf siren.

One-toed Amphiuma (*Amphiuma pholeter*)

Description

This eel-like salamander has one toe on each small leg. The color is uniformly dusky. Adults reach a length of about 25 cm. Other amphiumas have more than one toe on each foot and reach a larger size.

Range

The species occurs between the Gulf Hammock region and the Yellow River south of Crestview in the Florida peninsula and adjacent panhandle, as well as in southwest Georgia (Fig. 12). County records in Florida include Calhoun, Citrus, Gadsden, Jefferson, Levy, and Liberty. Specific locality records are not available for Georgia; however, its range in that State is known to be very restricted.

Habitat

This salamander is very secretive and inhabits muck-bottomed stream floodplains and other mucky habitats. These preferred sites are relatively uncommon (Means 1978*b*). Little is known of its ecological requirements.

Status

Populations now appear to be stable within the limited range (Ashton 1976). Considered a "Rare" species by the Florida Audubon Society and Florida Defenders of the Environment (Means 1978*b*).

Recommendations

- A survey is needed to determine the distribution and population numbers of this species.

Gulf Hammock Dwarf Siren (*Pseudobranchus striatus lustricolis*)

Description

A small, slender, eel-like salamander with a broad dark middorsal stripe, within which are three narrow light stripes, the central one down the middle of the back. There are two broad, sharply defined light stripes on each side of the body, one silvery-white and the other orange-brown. The belly is black with light flecking. Adults reach a length of about 20 cm (Martof 1972).

Range

This form is known from the Gulf Hammock region in northwestern Florida (Fig. 12). Records include Levy, Citrus, and Hernando counties (Neill 1951). Godley (1978) reported that it occurs only at three localities in Citrus and Levy counties.

Habitat

These dwarf sirens reportedly occur in shallow, freshwater habitats such as swamps, marshes, and sinkhole ponds, but do not seem to prefer areas with much aquatic vegetation, as other dwarf sirens do (Neill 1951). On the other hand, Godley (1978) stated that it occurs in weed-choked ponds in areas of cypress and flatwood, or in drainage ditches and small floodplain lakes.

Status

The status of this salamander is unknown. Much of its known range is within the Gulf Hammock Wildlife Management Area, Florida.

Recommendations

- Field work is needed to assess the distribution of this uncommon salamander.
- Habitat destruction and pollution of the known aquatic habitat should be avoided.

Rio Grande Lesser Siren (*Siren intermedia texana*)

Description

An eel-like aquatic salamander that reaches a total length of 66 cm. It has bushy external gills and tiny front feet, and lacks hind limbs. The dorsal color is

light brown to olive or gray with numerous black flecks or spots. The venter is light gray.

Range

This form was once known from many localities along the U.S. side of the Rio Grande, in Cameron, Kleberg, Hidalgo, Starr, Maverick, and Dimmit counties, Texas, and from one locality along the Mexican side (Fig. 13).

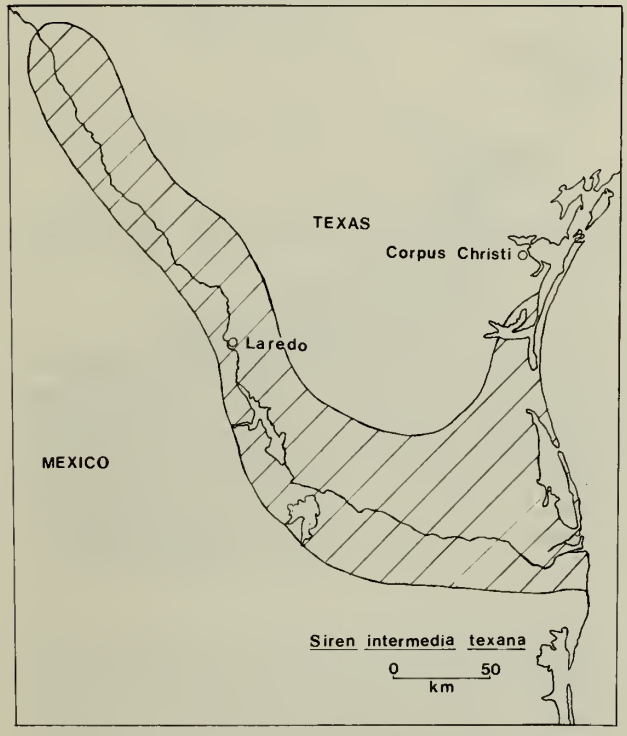


Fig. 13. Distribution of the Rio Grande lesser siren.

Habitat

Martof (1973) described the habitat for the whole species as "shallow, warm, quiet, sometimes turbid waters where vegetation abounds: swamps, ditches, sloughs, ponds, lakes, and to a lesser extent rivers and streams."

Status

It is threatened by drainage of ponds and swampy areas which are scarce in southern Texas, and by modification of the Rio Grande (Gehlbach 1962). This siren is protected in the Palm Jungle Sanctuary of the National Audubon Society and at the Santa Almo National Wildlife Refuge.

Recommendations

- A study is needed to determine the habitat requirements and distribution of this species.
- A portion of the marshland between Harlingen and Brownsville, Cameron County, should be protected as a wildlife preserve. The preserve should include suitable habitat for the large number of other tropical species whose ranges exceed the United States border in that area.
- Natural marsh conditions should be maintained at the Santa Almo National Wildlife Refuge.

Striped Newt (*Notophthalmus perstriatus*)

Description

A small salamander, up to 10 cm long, with a pair of bright to dull red dorsolateral stripes on the trunk that may be fragmented on the head and tail. Dorsal ground color is olive-green to dark brown. The belly is yellow and marked with black specks. The eft (juvenile) stage also has red stripes, but is dull orange or reddish brown in ground color (Christman and Means 1978). Neoteny is frequent in this species.

Range

The striped newt is confined to southeastern Georgia and northern Florida, west to Apalachee Bay (Fig. 14). Specific county locality records in Florida

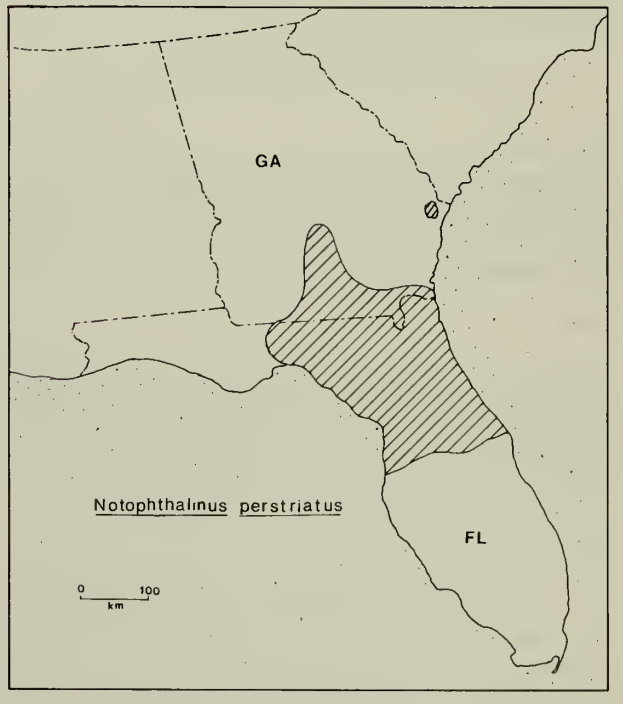


Fig. 14. Distribution of the striped newt.

include Alachua, Bradford, Citrus, Clay, Columbia, Dixie, Duval, Escambia, Gilchrist, Hernando, Leon, Marion, Orange, Putnam, Seminole, St. John, and Wakulla. Specific locality records are not available for Georgia.

Habitat

According to Mecham (1967), adults "are found in hammock ponds, flatwoods ponds, and the more permanent drainage ditches; efts in high and mesophytic hammocks on well drained soil, and in rosemary scrub, turkey-oak, and high pine." Christman and Means (1978) stated that adults are found most frequently in flatwoods in pine-palmetto habitats.

Status

The local distribution of this newt is spotty, making it vulnerable to habitat destruction (Christman and Means 1978). The progressive loss of the remaining habitat in a rapidly developing region appears to be the main problem affecting this species. Considered a "Rare" species by the Florida Audubon Society and Florida Defenders of the Environment (Christman and Means 1978).

Recommendations

- A survey is necessary to determine the distribution and population sizes of this species.
- Habitat destruction, particularly of breeding ponds and sites where this salamander is neotenic, should be prohibited.

Neuse River Waterdog (*Necturus lewisi*)

Description

An aquatic salamander with external gills. It is distinctly spotted above and below, with brown to black spots on a ground color of lighter brown. Adults reach a total length of 23 cm.

Range

Known from the Neuse and Tar rivers of North Carolina (Fig. 15), primarily in the Piedmont Physiographic Region (Fedak 1971). The range includes parts of Craven, Durham, Franklin, Granville, Johnston, Lenoir, Nash, Orange, Vance, and Wake counties.

Habitat

It is found among large accumulations of submerged leaves in eddies, or backwaters of streams and rivers. Such areas provide cover and potential food, including darters, pirate perch (*Aphredoderus sayanus*), and a wide variety of invertebrates—especially crayfish (Fedak 1971). Only recently have the larvae and nest of this species been described (Ashton and Braswell 1979).

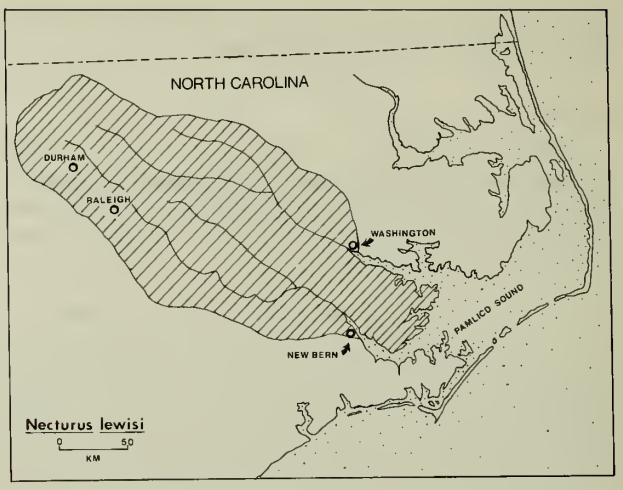


Fig. 15. Distribution of the Neuse River waterdog.

Status

Extensive plans for dams above the fall line threaten nearly all of the localities where this species is abundant. It is threatened by both habitat destruction (manipulation of aquatic habitat and siltation) and pollution (Ashton 1976). This species is listed as of "Special Concern" in the State of North Carolina. Herpetologists believe it may be locally abundant at certain sites (J. Cooper, personal communication).

Recommendations

- Known populations of this salamander should be protected from inundation by reservoirs.
- Water pollution and siltation needs to be reduced along the Neuse and Tar rivers.
- The region within and surrounding its known range should be surveyed to locate extant populations.

Flatwoods Salamander (*Ambystoma cingulatum*)

Description

A small black salamander in which most individuals have a reticular pattern of gray or white on the back. The belly is generally black but may have a pepper-and-salt appearance. Adults may reach a total length of about 13 cm, but most are about 10 cm long (Martof 1968).

Range

The range of this salamander extends from southern

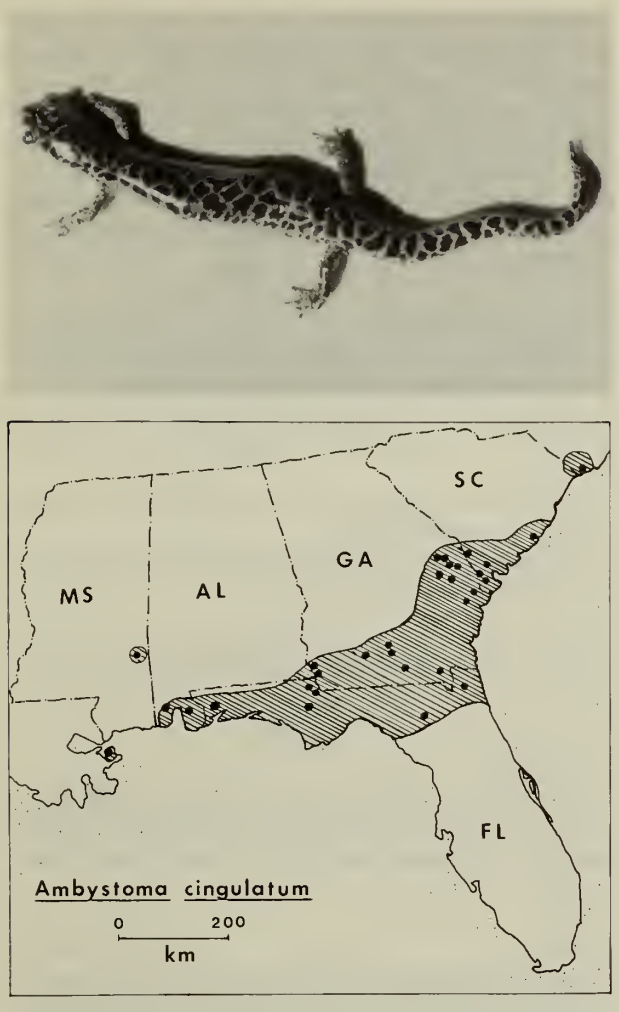


Fig. 16. Adult flatwoods salamander and its range. (Photo by C. K. Dodd)

South Carolina, across Georgia and northern Florida, and along the Gulf Coast of Alabama into Mississippi (Fig. 16). An isolated population occurs in North Carolina. Specific county locality records include, but are not necessarily limited to, the following:

Alabama: Baldwin, Covington, and Mobile.
Florida: Alachua, Baker, Calhoun, Duval, Escambia, Jackson, and Santa Rosa.
Georgia: Ben Hill, Effingham, Irwin, and Worth.
Mississippi: No specific localities.
North Carolina: Brunswick.
South Carolina: Beaufort and Berkeley.

Habitat

The habitat of this salamander is "low pine flatwoods of the type usually dominated by slash pine and wiregrass" (Mount 1976). Longleaf pine was the natural habitat type but forestation practices have changed many of these stands. Breeding occurs in shallow flatwoods ponds and areas of cypress domes, and wiregrass apparently must be present for successful egg laying.

Status

The main factor affecting the status of this species is habitat destruction, primarily by clear-cutting, mechanical site preparation, and burning of wiregrass. Most burning by land managers is done in winter; this practice is detrimental to wiregrass because it is adapted to summer fires (S. Christman, personal communication). Conversion of land into permanent ponds also destroys much habitat. This salamander appears to be rare throughout much of its range.

Recommendations

- A survey of the status and distribution of this species should be undertaken.
- Clear-cutting and intensive mechanical site preparation in areas where this salamander occurs should be avoided—especially in the vicinity of breeding sites.
- Winter burning of wiregrass and woods may adversely affect the salamander because this is the period of surface activity. Summer fires apparently are needed for reproduction of wiregrass, and at this time *Ambystoma cingulatum* is beneath the soil.

Santa Cruz Long-toed Salamander (*Ambystoma macrodactylum croceum*)

Description

Adults are up to 13 cm in total length and have noticeably long toes, compared with other salamanders. The color is striking: irregular middorsal spotting of yellow-gold or orange on a black background. The venter is sooty-colored. A synopsis of the species was given by Ferguson (1963).

Range

This form is known only from three localities in Santa Cruz County, California: Valencia Lagoon near Aptos; a pond near Valencia Lagoon; Ellicott Pond, 6.4 km west of Watsonville; and from several sites 1.6-2.4 km north of Moss Landing in Monterey County, California (California Fish and Game 1978; E. C. Fullerton, personal communication). The areas are shown in Fig. 17.

Habitat

This salamander occurs in oak woodland and grassland areas. It breeds in temporary ponds. During the

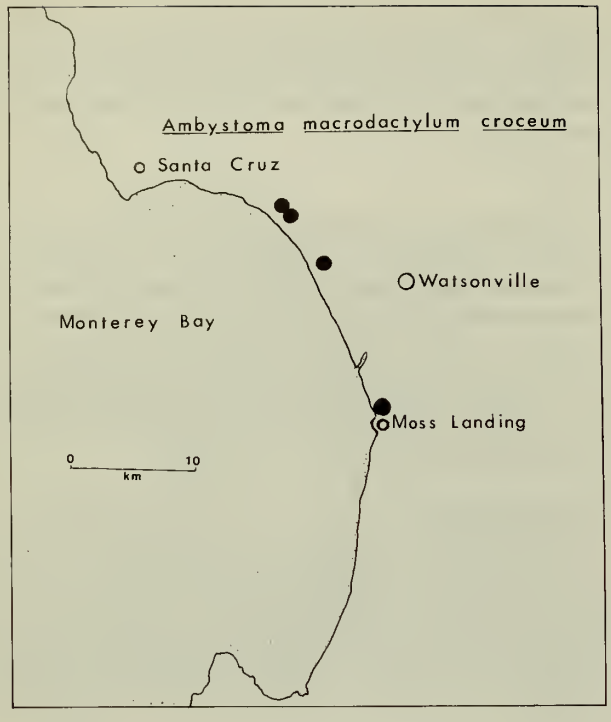


Fig. 17. Distribution of the Santa Cruz long-toed salamander in central California.

dry months the salamanders take refuge in nearby willow thickets, oak woodlands, and chaparral (California Fish and Game 1974, 1978).

Status

Valencia Lagoon has been greatly modified by freeway construction (State Route 101), and Ellicott Pond once was threatened by the proposed construction of a mobile-home park. Argicultural and subdivision developments currently threaten the site north of Moss Landing.

Substantial progress has been made to protect this salamander. After inadvertently draining the breeding pond, the California Division of Highways improved the habitat at Valencia Lagoon by constructing an artificial breeding pond. Funds of the California Environmental Protection Program (from the sale of personalized license plates) purchased about 1.2 ha of critical wetlands at Valencia Lagoon and 12 ha at Ellicott Pond. The U.S. Fish and Wildlife Service acquired 47 ha of habitat in 1974-75 at the Ellicott site. The combined efforts of citizens, students, scientists, State of California engineers and biologists, and Federal personnel during the last 6 years has saved this salamander from extinction (Bury 1972; Bury and Ruth 1972; Ruth and Tollestrup 1973; Ruth 1974).

Recently, the Santa Cruz County board of supervisors adopted zoning laws which are aimed at the protection of this salamander and its habitat. This salamander is fully protected by the State of California. It is listed as Endangered on the U.S. List of Endangered and Threatened Wildlife and its Critical Habitat has been identified. An Endangered Species Recovery Team is coordinating continued efforts to protect this life form.

Recommendations

- Studies to monitor reproductive success and population size should be continued in all localities.
- Upland habitat near breeding ponds, which is essential for the survival of the adult stage, should be obtained.
- Valencia Lagoon should be returned to its pristine state in available space.
- Additional land should be purchased at localities at which this species is discovered.

Sacramento Mountain Salamander (*Aneides hardii*)

Description

A slender-bodied salamander reaching a total length of 9 cm. Adults are primarily brown above and lighter below. The young may have a light brown dorsal stripe.

Range

This species is known only from the Capitan Mountains, Sacramento Mountains, and Sierra Blanca of southern New Mexico in Lincoln and Otero counties (Wake 1965). Occurs largely within Lincoln National Forest (Fig. 18).

Habitat

This salamander is found primarily in association with Engelmann spruce, Douglas-fir, and white fir at elevations of 2,590-3,350 m. It lives in and under downed logs (especially Douglas-fir), under wet talus, and in subterranean retreats. Old logs with moist, rotting interiors are particularly favored as sites for egg laying (Johnson and Schad 1959). Mature forests with downed logs seem to be essential habitat requirements.

Status

These salamanders are seasonally common, but restricted to a specific localized habitat that could be at least partly destroyed by logging or road building. This species is listed as "Endangered" by the State of New Mexico (Campbell 1975).

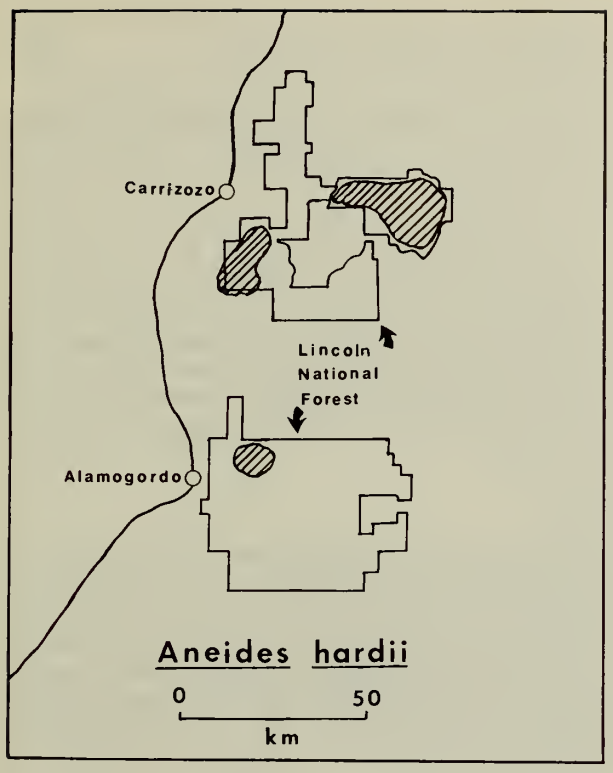


Fig. 18. Range of the Sacramento Mountain salamander in southern New Mexico.

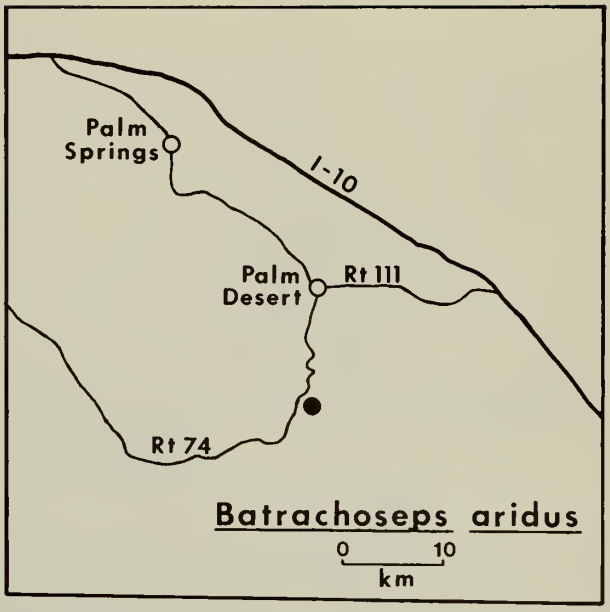


Fig. 19. The only known locality of the desert slender salamander in southern California.

Recommendations

- Tracts of mature, climax forest should be maintained within the salamander's known range.
- For logging that is allowed, as much shade and downed slash as possible should be left to keep the ground cool and moist.
- Collecting that involves the destruction of habitat (e.g., the ripping apart of logs) should be reduced or stopped.
- A habitat management plan needs to be developed for this species on public lands.

Desert Slender Salamander (*Batrachoseps aridus*)

Description

A small slender salamander with thin weak legs. Dorsally it is a blackish-maroon with a lighter, indistinct dorsal stripe. The venter is a darker blackish-maroon. Adults grow to a total length of 12 cm.

Range

This salamander is known only from Hidden Palm Canyon (Fig. 19), a tributary to Deep Canyon, 16 km south of Palm Desert, Riverside County, California (Brame 1970).

Habitat

The Desert slender salamander inhabits crevices beneath limestone slabs and other rocks where there is a continual seepage of water at the base of cliffs (California Fish and Game 1978).

Status

The principal habitat (54 ha) has been purchased by the California Department of Fish and Game and is designated as the Hidden Palm Ecological Reserve. Collection, possession, and sale of this salamander are prohibited by State law. This species is listed as Endangered by the USDI (1973).

Recommendations

- Protected status must be maintained by the State.
- Search for additional populations of this salamander should be made in suitable habitat.

Kern Canyon Slender Salamander (*Batrachoseps simatus*)

Description

An elongate, slender salamander having long spindly legs and a long tail. The sides and venter are

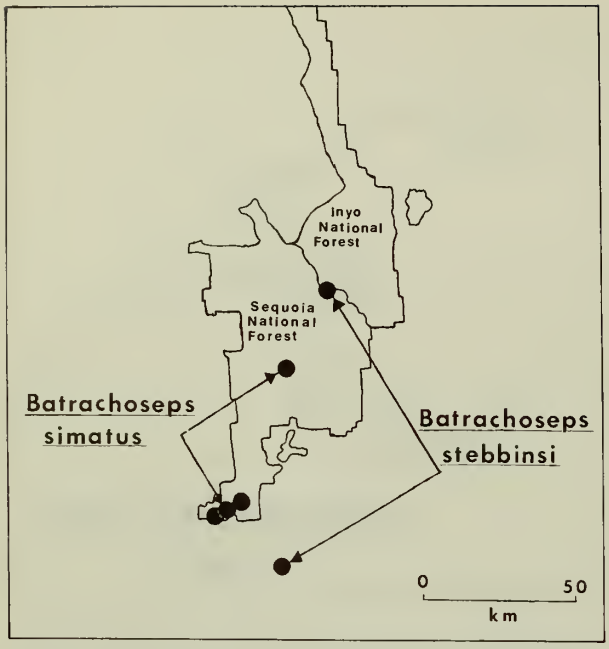


Fig. 20. Distributions of the Kern Canyon slender salamander (*B. simatus*) and the Tehachapi slender salamander (*B. stebbinsi*) in the southern Sierra Nevada foothills of California.

black. The back has flecks of bronze and light brown pigment which may form an imperfect dorsal band. Adults reach a total length of 13 cm.

Range

This species is known from seven localities along the south side of the Kern River Canyon west of Democrat Hot Springs, Kern County, and one locality near Fairview above Lake Isabella, Tulare County, California (Brame and Murray 1968). The location of these sites are shown in Fig. 20.

Habitat

This salamander is found under downed pine, oak, and chaparral scrub logs as well as under rocks and talus on steep north-facing slopes.

Status

The Kern Canyon slender salamander is locally abundant. Collection, possession, and sale of these animals are prohibited by State law in California.

Recommendations

- Disturbance of the habitat should be avoided by careful planning of necessary roads.
- Part of the Kern River Canyon with known populations of this salamander should be set aside as a wildlife preserve or left in a natural state.

Tehachapi Slender Salamander (*Batrachoseps stebbinsi*)

Description

A salamander much larger and more robust than other members of the genus *Batrachoseps*, yet it is still relatively long and slender, and has weak legs. The sides and tail are deep black; the dorsal surface is distinctly marked with scattered patches or blotches of red, dark brown, or beige that sometimes form an indistinct dorsal stripe. Adults reach a total length of 13 to 15 cm.

Range

This salamander has been collected at one locality in Tulare County near Keen and in five small areas in the Piute and Tehachapi Mountains east of Bakersfield, Kern County, California (Fig. 20). Recently reported from near Beach Meadows Guard Station in Sequoia National Forest (Richman 1973), this range extension suggests that the species may be more widespread than now known.

Habitat

This species is found in rock talus and among wet leaves in foothill, woodland, and riparian vegetation.

Status

Scarce within its restricted range. Collection, possession, and sale of this species are prohibited by California law. Much of the habitat in Tulare County has been destroyed by the construction of a freeway (U.S. Interstate 466).

Recommendations

- Any future road construction should be carefully planned to minimize disturbance of this species' habitat, especially along the Lorraine-Bodfish Road.
- A survey is warranted to determine the geographic limits of this species.

Dark-sided Salamander (*Eurycea aquatica*)

Description

A moderate-sized salamander that has short, well-developed legs. It is dusky black on the sides with a lighter dorsal stripe. The venter is dull yellow. Adults are 9 cm in total length; the tail is shorter than the body.

Range

This species is known from only three localities. It was originally reported from a point 3.2 km west of Bessemer, along County Highway 20, Jefferson County, Alabama (Fig. 21). It is now known from Davidson County, Tennessee, and is possibly more widespread in central Tennessee and elsewhere.

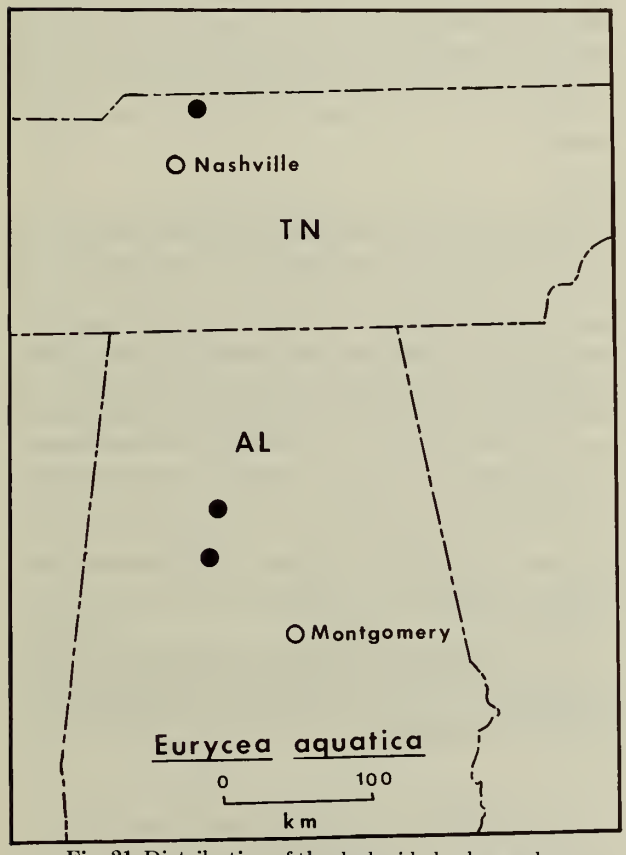


Fig. 21. Distribution of the dark-sided salamander.

Habitat

The habitat at the type locality was described by Rose and Bush (1963) as "a series of small natural springs that converge to form a stream. The water is clear, has an average yearly temperature less than 60 F [15 C]. The spring and stream beds are mostly gravel and sand. Near the middle of the stream is a heavy growth of water cress, *Nasturtium officinale;* most of the adult *E. aquatica* were collected along the shallow edges where sand had accumulated; here the dominant plant was wild spearmint, *Mentha spicata.* Individuals seem to avoid the silted areas almost entirely and none were found along the stream bank."

Status

"The springs in the area of the type locality of *Eurycea aquatica* are very small and transformed animals in this area are virtually non-existent. Wholesale destruction of the springs was hastened by the discovery of endemic fish (Water Cress Darter, *Etheostoma nuchale*) in the area and undisciplined herpetological collecting" (Rose 1971). The Tennessee population is reportedly stable (Ashton 1976).

Conant (1975) stated that some authorities contend that this salamander should not be classified as a distinct species, and that it actually represents aberrant individuals or populations of the widespread *Eurycea bislineata.* Mount (1975) reported that *E. aquatica* probably represents an ecotype of *E. bislineata.*

Recommendations

- The Bessemer locality should be protected as a wildlife preserve for both the salamander and the watercress darter (which is also Endangered).
- The stream and a surrounding buffer zone should be purchased if necessary to protect this form.
- Collecting should be held to a minimum.
- As few impurities as possible should be allowed to enter the stream.
- Anything that would increase siltation in the stream should be avoided.
- The systematic status of this form needs to be clarified.

Cascade Cavern Salamander (*Eurycea latitans*)

Description

Adults of this form are aquatic and reach a total length of 12 cm. They retain their gills, and have thin legs and a greatly flattened snout. They are primarily light tan above with dark reticulations on the sides and back. A synopsis of the species was given by Brown (1967*a*). S. Sweet (personal communication) believes that this may not be a valid species.

Range

This species is restricted to Cascade Cavern and a few surrounding, interconnected caves, 5.6 km southeast of Boerne, Kendall County, Texas (Baker 1961; Sweet 1976). This locality is shown in Fig. 22. It may be more widespread in underground aquifers.

Habitat

Eurycea latitans is found only in subterranean water systems in the vicinity of Cascade Cavern.

Status

This salamander would probably be exterminated if

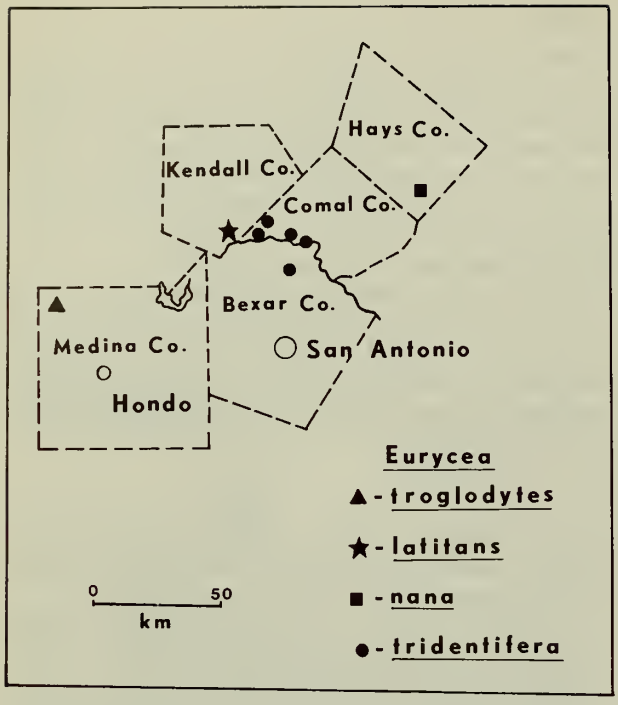


Fig. 22. Occurrences of four species of brook salamanders (*Eurycea*) in Texas.

the underground waterway in which it lives were flooded or polluted. Individuals were extremely uncommon in 1973 (F. Hendricks, personal communication).

This species is listed as a "Protected" species in the State of Texas.

Recommendations

- At least one cave and the underground waterway should be protected as a wildlife preserve; the cave should be purchased if necessary to protect this species.
- Collecting in any of the caves should be held to a minimum and allowed by permit only.
- As few impurities as possible should be allowed to enter the water system around the cave. This may be the most important protection, as the species appears to live in an aquifer.

San Marcos Salamander (*Eurycea nana*)

Description

Eurycea nana is a slender, short-legged neotenic salamander with external gills. It is primarily light brown above and white below. Adults reach a total length of 5 cm.

Range

This species is known only from San Marcos Springs at the head of the San Marcos River, and about 4 km downstream from this site, in Hays County, Texas (Baker 1961; Brown 1967*b*). The location of this site is shown in Fig. 22.

Habitat

This salamander is found among water plants and algal mats in the head springs area (Baker 1961), where it is sympatric with two species of endemic fish, the San Marcos gambusia (*Gambusia georgei*) and the fountain darter (*Etheostoma fonticola*). The *Gambusia* has been proposed as an Endangered species at the Federal level and the fountain darter is already listed as such.

Status

This salamander principally inhabits one spring area and could easily become extinct if water pollution or any major disturbance occurred. A river near the site has been dammed (G. Longley, personal communication). The salamander was reported as being abundant in 1969 (F. Gehlbach, personal communication), and the population size remains stable (S. Sweet, personal communication). The current landowner does not allow collecting of this species (G. Longley, personal communication). Longley (1978) has shown that if groundwater pumping continues at its present rate in the area, San Marcos Springs could become intermittent by 1985, thus leading to the certain extinction of this species.

This salamander is listed as a "Protected" species by the State of Texas and has been proposed as Threatened on the U.S. List of Endangered and Threatened Wildlife.

Recommendations

- The spring and a surrounding buffer area should be protected as a wildlife preserve for both the salamander and fish.
- Collecting should be held to a minimum.
- As few impurities as possible should be allowed to enter the water system near the spring.
- Pumping of groundwater should be prohibited in the areas adjacent to and above San Marcos Springs.

Comal Blind Salamander (*Eurycea tridentifera*)

Description

An unusual pigmentless, troglodytic salamander with bright, blood-red gills, tiny nonfunctional eyes, and long spindly legs. It has a wide head with a somewhat flattened snout. Adults reach a total length of

7.5 to 8.5 cm (Sweet 1977). Although this salamander was once considered to belong in the related genus *Typhlomolge* (Wake 1966), it is now placed in the genus *Eurycea* (Mitchell and Smith 1972; Conant 1975; Sweet 1977; D. B. Wake, personal communication).

Range

This blind salamander is known from Honey Creek Cave, near the town of Spring Branch, Comal County, Texas (Mitchell and Reddell 1965), and from several other caves in Comal County and at one site in adjacent Bexar County (F. Hendricks, personal communication; Sweet 1976, 1977). Its distribution is shown in Fig. 22.

Habitat

Honey Creek Cave is primarily a long water passage. The water is about 20 C and flows at a moderate rate (Mitchell and Reddell 1965).

Status

Most of the localities are inaccessible to general collectors because of the remoteness and difficulties involved in cave work (F. Hendricks, personal communication).

This species is listed as "Rare" by the State of Texas.

Recommendations

- Honey Creek Cave should be protected as a wildlife preserve.
- Collecting should be held to a minimum.
- As few impurities as possible should be allowed to enter the water system near the occupied caves and associated aquifer.

Valdina Farms Salamander (*Eurycea troglodytes*)

Description

An aquatic salamander that has gills, long slender legs, a somewhat flattened snout, and greatly reduced eyes. Adults are light gray with some yellow and white markings, and reach a total length of 7.5 cm (Baker 1966).

Range

Eurycea troglodytes is known from only one locality (Fig. 22), "a pool approximately 600 feet [183 m] from the entrance of the Valdina Farms Sinkhole, Valdina Farms (16 mi. [30 km] N. of D'Hanis, in northwestern) Medina County, Texas" (Baker 1957).

Habitat

"Most of the salamanders . . . inhabited a crystal pool of water approximately three feet [0.9 m] deep, five feet [1.5 m] wide, and 90 feet [27 m] long; . . . the bottom is covered by several inches of silt and guano. . . . It was noted, however, that the salamanders inhabited only those pools containing guano. Enormous flights of bats pass over some of the pools in this sinkhole, and their droppings and/or decaying dead are evidently utilized as food material by the salamanders, either directly or indirectly" (Baker 1957).

Status

The number of individuals in this population is unknown. This species is restricted to specific kinds of pools in a very limited area. The relationship between the bats and salamanders could be critically important to the survival of this species.

There are current plans to flood Valdina Farms sinkhole (by diverting water from nearby Seco Creek) to serve as a recharge point for the Edwards aquifer. The resulting massive amounts of water entering the cave could disrupt the ecosystem sufficiently to lead to the eventual extinction of this species (S. Sweet, personal communication). The systematic status of this species may be questionable (S. Sweet, personal communication).

This species is listed as "Protected" by the State of Texas and a review of its status has been proposed by the U.S. Fish and Wildlife Service.

Recommendations

- The sinkhole and stream should be protected as a wildlife preserve.
- Human access to the sinkhole should be limited, to reduce disturbance of the bats, salamanders, and other resident fauna. No alterations of the entrance should be made that might restrict the movement of bats.
- Collecting should be held to a minimum and allowed by permit only.
- As few impurities as possible should be allowed to enter the water system around the spring.
- Inasmuch as this species may live in underground aquifers, and individuals found in pools near the surface may be "washouts" from the population (H. W. Campbell, personal communication), protection of the aquifer is vitally important to the species.
- All water-diversion plans should be abandoned until systematic studies are completed on the biology of this species and on the hydrology of the cave.

Oklahoma Salamander (*Eurycea tynerensis*)

Description

A neotenic salamander that has gills, an elongate

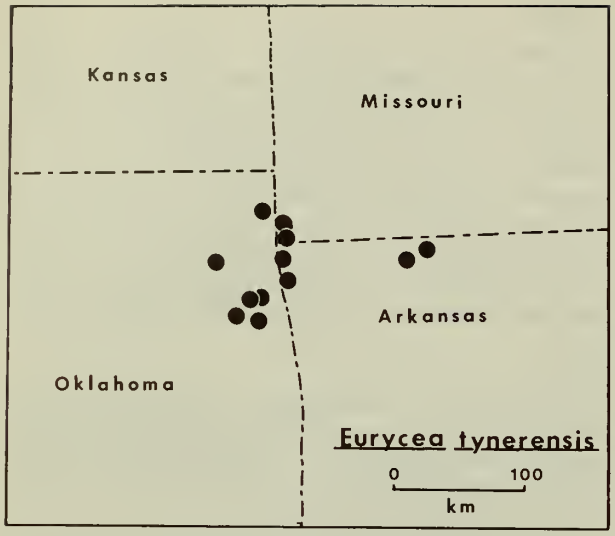


Fig. 23. Distribution of the Oklahoma salamander.

body, and short limbs. It is gray with dark markings dorsally and pale ventrally. Adults reach a total length of 8.3 cm.

Range

The Oklahoma salamander has been reported by Dundee (1965) from 10 localities in two river drainages—those of the Grand (Neosho) and Illinois rivers of the Ozark Plateau in northwestern Arkansas (Benton and Washington counties), northeastern Oklahoma (Adair, Cherokee, Delaware, Mayes, and Ottawa counties), and southwestern Missouri (McDonald County). R. Ashton (personal communication) has found *E. tynerensis* in Carroll County, Arkansas, near the Missouri border. The range is shown in Fig. 23.

Habitat

Moore and Hughes (1939) originally described the habitat as the "interstices between stones and pebbles in coarse loose sand under cold swift shallow water of springs and small streams." Dundee (1965) wrote "It is apparently confined to small spring-fed, gravel-bottomed streams with temperatures normally not exceeding 24 C and to altitudes under 350 m (1000 feet). Animals tend to remain in very localized parts of streams in association with specific qualities of substratum." R. Ashton (personal communication) has found the species in streams with bedrock and some flat stones.

Status

Individuals are common where there is suitable habitat, but such areas are rapidly being destroyed by construction projects (H. W. Campbell, personal communication).

Other threats are agricultural use, urbanization, and manipulation of the aquatic habitat (Ashton 1976).

This species is listed as "Rare and Endangered" in the State of Missouri.

Recommendations

- Ecological studies should be undertaken to determine present population status.
- Alteration (e.g., channelization) of streams should be curtailed because of the danger of increased silting which is deleterious to the microhabitat important to this aquatic species.
- An entire drainage in the appropriate headwaters should be purchased or otherwise protected by agreement, to preserve suitable habitat.

Tennessee Cave Salamander (*Gyrinophilus palleucus*)

Description

This species is a pale, neotenic salamander with small eyes that lack eyelids. The head is broad and the snout is flattened and spatulate. Adults reach a total length of about 18 cm.

Range

This salamander is known only from caves and underground waters in Tennessee, Alabama, and Georgia (Fig. 24). Localities include a number of caves in the following counties: Alabama—Jackson (5), Colbert (1), Limestone (1), Madison (1); Georgia—Walker (2); Tennessee—Franklin (5), Grundy (1), Marion (1), McMinn (1), and Roane (1) (Brandon 1967*a*; Cooper 1968; Cooper and Cooper 1968; Mount 1976). Other populations probably remain to be discovered.

Habitat

This form occurs in streams (in caves) with a supply of amphipods and other aquatic organisms that can serve as food. Little is known about its specific ecological requirements. It is occasionally encountered in epigean environments, probably as washouts from caves.

Status

The limited range of this species, coupled with the fragile nature of its environment, has caused this species to be listed as of "Special Concern" in Alabama (Mount 1976). This species is listed as "Threatened" by the State of Tennessee. Its status is largely unknown.

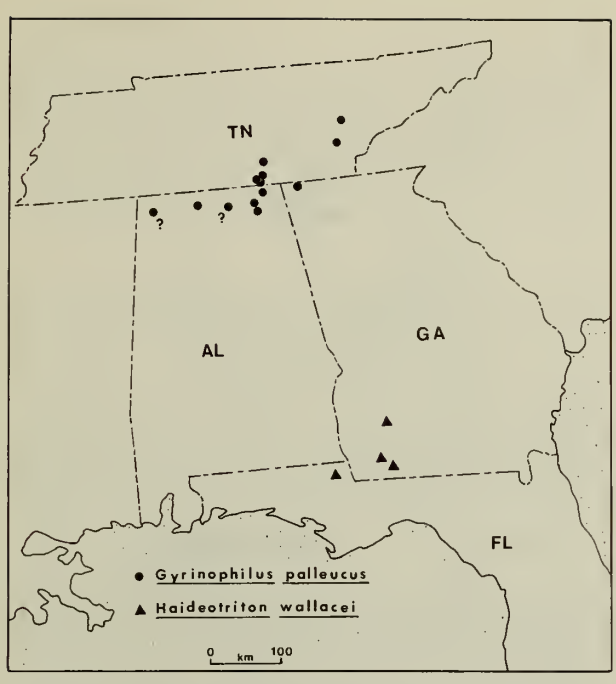


Fig. 24. Distributions of the Tennessee cave salamander (*G. palleucus*) and the Georgia blind salamander (*H. wallacei*).

Recommendations

- Field studies are needed to determine the distribution and relative abundance of this species.
- The amount of human "traffic" in caves where this species occurs should be controlled, to avoid disturbing or polluting the salamander's environment.
- Pollution of groundwater should be minimized or curtailed near sites with viable populations.

Georgia Blind Salamander (*Haideotriton wallacei*)

Description

This is a pale, pinkish-white salamander with tiny "eyes," slender legs, and bright red gills. Adults are completely aquatic and reach a total length of 75 mm. This salamander is unique in being the only subterranean blind salamander east of the Mississippi River.

Range

The species is restricted to the Dougherty Plains region of Jackson County, Florida, and Decatur and Dougherty counties, Georgia (Fig. 24), where it has been reported from only four localities (Brandon 1967*b*; Odom 1976; Means 1978*c*). Other populations are known to exist in the same general region but data on their occurrence have not been published.

Habitat

This salamander is found in clear pools of underground waterways. It has been found only in the complete darkness of caves (Brandon 1967*b*).

Status

Numbers of individuals in at least one cave have been considered to be decreasing. However, this is a "washout" cave to which the animals presumably were carried by high water. The main populations are in underground aquifers and apparently are not depleted by the loss of isolated individuals that are washed into surface caves. The population size of the species is unknown, but the salamander does not now appear to be threatened with extinction (H. W. Campbell, personal communication). Caves and sinkholes provide the nutrients for the subterranean ecosystem and these openings must be protected for the survival of this underground species (S. Christman, personal communication).

Georgia lists *H. wallacei* as an "Unusual Species" that merits protection. The Florida Audubon Society and Florida Defenders of the Environment consider it a "Rare" species (Means 1978*c*).

Recommendations

- A survey of caves in the Dougherty Plain is needed to determine the distribution and abundance of this salamander.
- No alteration of the water table (as by damming or quarrying) should be allowed in areas of known populations.
- Private or governmental purchases of caves where populations of this salamander are known to occur should be encouraged.

Limestone Salamander (*Hydromantes brunus*)

Description

A unique terrestrial salamander that has a flattened head and body, long legs, and webbed toes. It is uniformly brown above and cream to pale gray below. Young are yellow-green to dull yellow (Gorman 1964). Adults grow to 10 cm in total length.

Range

The species is reported from seven localities in the vicinity of Briceburg and Bear Creek, along the Merced River, Mariposa County, California (California Fish and Game 1978). Its distribution is shown in Fig. 25.

Habitat

This salamander is always associated with limestone

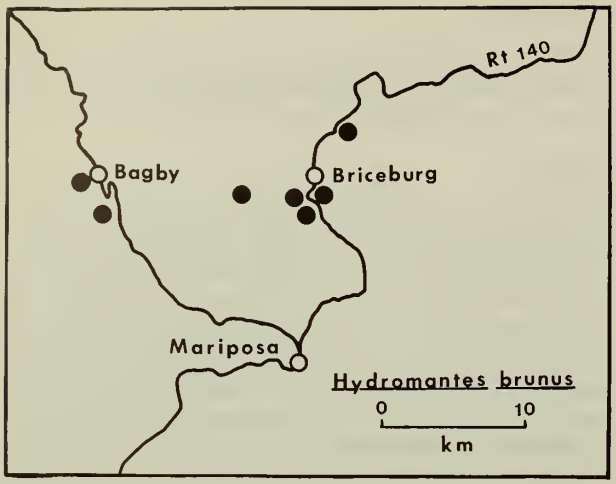


Fig. 25. Distribution of the limestone salamander in central California.

outcrops in the digger pine-chaparral belt along the Merced River Canyon. Individuals are found under wet talus and in rock crevices, especially where overgrown with moss (Stebbins 1966)

Status

The restricted range makes this salamander extremely susceptible to any modification of its habitat, especially the widening of the existing highway or further damming of the Merced River. Collection, possession, and sale of this species are prohibited by State law in California.

A 48-ha parcel of habitat near Briceburg was purchased by the State of California in 1974 and is now the Limestone Salamander Ecological Reserve.

Recommendations

- The known population should be protected in a wildlife preserve to protect this species' habitat (California Fish and Game 1978).
- Research should be conducted on the distribution and natural history of this species.

Shasta Salamander (*Hydromantes shastae*)

Description

This species is similar to the limestone salamander; it has a flattened head and body, long legs, and webbed toes. The dorsal color is gray-green, beige, or tan with an irregular pattern on a darker ground color. The venter is blotched with white. Adults reach a total length of 10 cm.

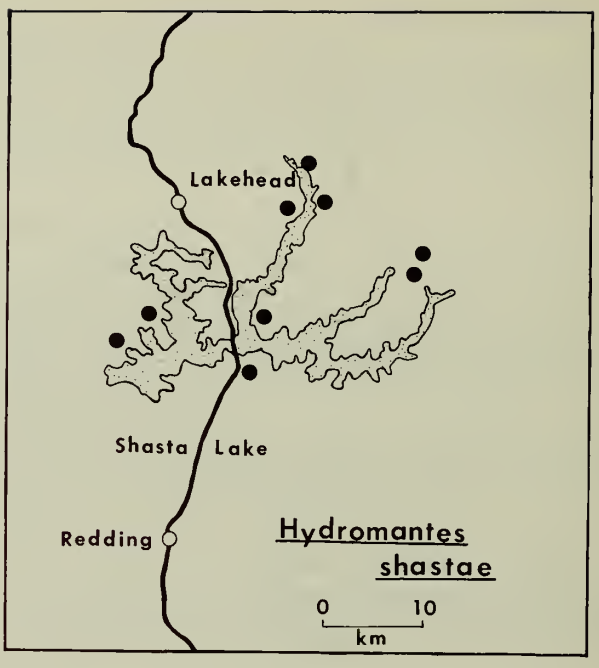


Fig. 26. Occurrence of the Shasta salamander in northern California.

Range

This salamander has been reported along the northern side of Shasta Lake, between the McCloud and Pit rivers, Shasta County, California (Bury et al. 1969). It was recently discovered just south of Shasta Lake and on the west side of the Lake (T. Papenfuss, personal communication). The populations apparently are isolated from one another (Fig. 26).

Habitat

This form is closely associated with limestone, usually in cool, wet ravines and valleys. The dominant vegetation is oak woodland or chaparral, but may include woods of fir and pine. Individuals frequent moist limestone fissures or caves, though occasionally they are found nearby under logs and talus during wet weather (Bury et al. 1969)

Status

Collection, possession, and sale of this animal are prohibited by State law in California. Most of its habitat is now secure from alteration because much of it is steep, remote terrain; however, certain limestone outcrops could be disrupted by mining operations. A study of its distribution is being funded by the U.S. Forest Service and by the Bureau of Land Management.

Recommendations

- Several of the limestone outcrops in the vicinity of Lake Shasta should be protected to ensure the survival of *Hydromantes shastae* and many other animals associated with these ancient rock formations.
- A habitat management plan needs to be developed for this species on Federal lands.

Red Hills Salamander (*Phaeognathus hubrichti*)

Description

A woodland salamander that is a unique fossorial (burrowing) form. It has a uniformly dark body, small legs, large protuberant eyes, and a long stocky tail. Adults reach a total length of 23 cm (Brandon 1966).

Range

This species is restricted to the Red Hills physiographic province of the Coastal Plain in Alabama (Fig. 27). It has been reported from five counties in southern Alabama: Butler, Conecuh, Covington, Crenshaw, and Monroe (Schwaner and Mount 1970; French 1976; French and Mount, 1978).

Habitat

Phaeognathus hubrichti lives in burrows along cool, moist, shady ravines where the topsoil is usually a sandy loam. Big-leaf magnolia, southern magnolia, mountain laurel, and oak-leaf hydrangea are indicative of suitable habitat. The salamander is not found associated with pine, which grows in similar soil (Jordon and Mount 1975).

Status

The entire geographic range of the species is confined to a small area of south-central Alabama. Within its range are about 24,300 ha of habitat currently capable of supporting populations of the Red Hills salamander. Of that habitat nearly 60% is owned or leased by paper companies, which harvest timber primarily by clear-cutting. This technique of forest management, coupled with site preparation for replanting, completely destroys the habitat of the salamander. The rest of the available habitat, most of which is privately owned, is also subject to alteration. The conversion from forest land to pasture or cropland occurring in this area is equally destructive. The specialized habits of this species, along with its presumed low reproductive rate and inability to disperse, preclude its expansion into adjacent areas.

Overcollecting may have caused a decline in salamander populations in certain areas (Jordon and Mount 1975).

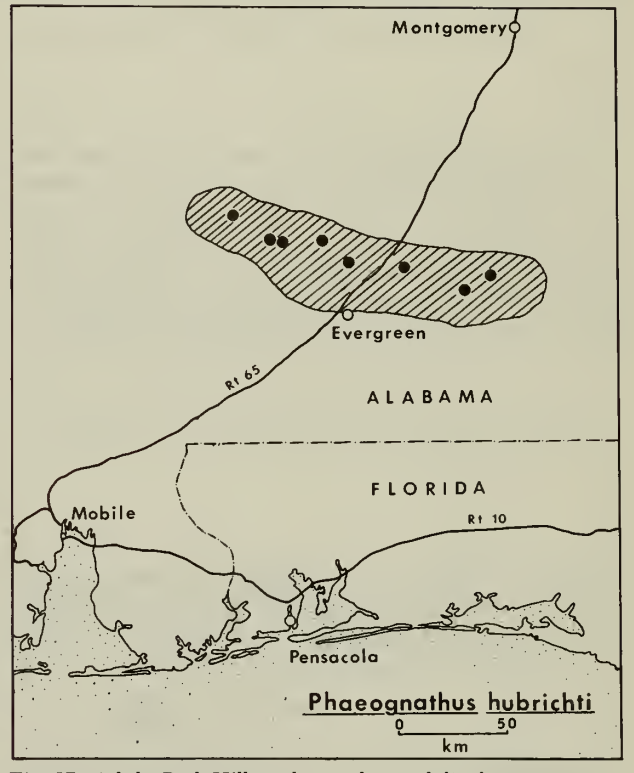


Fig. 27. Adult Red Hills salamander and its known range. (Photo by C. K. Dodd)

The International Paper Company has proposed a management plan for populations of the Red Hills salamander on its properties, which includes four provisions: (1) prohibiting clear-cutting and mechanical site preparation; (2) leaving a buffer zone around salamander populations; (3) avoiding new road construction; and (4) consulting with zoologists to define habitat and determine population distribution.

This species is listed as Threatened on the U.S. List

of Endangered and Threatened Wildlife, and as "Endangered" by the State of Alabama.

Recommendations

- Several tracts of suitable habitat of no less than 40 ha should be protected as wildlife preserves.
- The effects of timber harvesting, particularly in ravines with native forest, need to be monitored; changes in operations may be necessary to ensure the survival of local populations.

Larch Mountain Salamander (*Plethodon larselli*)

Description

This species is a slender salamander with black sides and a distinct reddish to yellow dorsal stripe. The venter is light orange. Adults reach a total length of 10 cm.

Range

The Larch Mountain salamander is known from nine localities along 53 km of the Columbia River between the towns of Hood River and Troutdale, Oregon (Fig. 28). Six of the localities are on the Oregon side of the River, mostly within Mt. Hood National Forest in Multnomah and Hood River counties; the other three are in Skamania County, Washington (Brodie 1970).

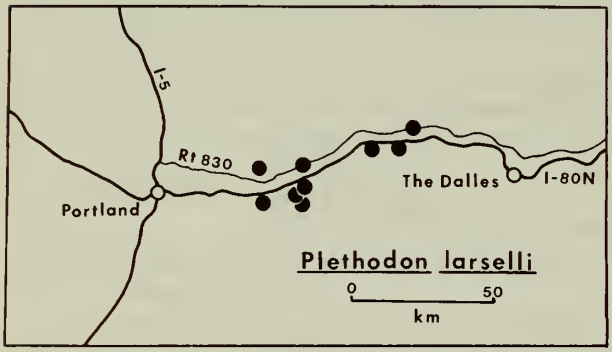


Fig. 28. Distribution of the Larch Mountain salamander along the Columbia River in Oregon and Washington.

Habitat

This salamander lives in talus rock slopes along the Columbia River gorge, especially where there is considerable growth of mosses. It is found under rocks and bark as well as inside rotting logs, and is generally associated with dense stands of Douglas-fir (Burns 1964; Stebbins 1966).

Status

Abundance of populations is unknown, but this salamander is found seasonally and is usually uncommon. The localities within Mt. Hood National Forest are currently being managed as a roadless area.

This species is protected by the State of Oregon.

Recommendations

- The habitat should be protected from commercial development and from logging.
- In logging that is allowed, as much shade and downed slash should be left as possible, to help keep the ground cool and moist.
- Storm (1966) suggested that insect control programs in the Columbia Gorge should be carefully controlled until more is known about the range and numbers of this salamander.
- Collecting that involves habitat destruction (e.g., pulling moss off rocks, ripping logs apart) should be reduced or stopped.
- Because the Oregon side of the Columbia River is especially beautiful and has unusual lava formations, it merits consideration as a nature preserve.

Jemez Mountains Salamander (*Plethodon neomexicanus*)

Description

A slender, elongate woodland salamander, dark brown with fine brassy flecks dorsally and lighter brown below. Adults reach a total length of about 13 cm.

Range

This species is known from 12 localities in the Jemez Mountains within Los Alamos and Sandoval counties, New Mexico (Williams 1972, 1973). Its range is shown in Fig. 29.

Habitat

The Jemez Mountains salamander is found in isolated, north-facing slopes and sheltered canyons above 2,200 m. It is associated with fir, maple, spruce, pine, and aspen. Individuals are found under moss-covered rocks or downed conifers in places where the ground is moist (Stebbins 1966; Reagan 1972).

Status

The restricted range of this species makes it vulnerable to commercial developments and logging. Most populations are within the Santa Fe National Forest. Individuals are locally abundant.

This species is listed as "Endangered" by the State of New Mexico (Campbell 1975).

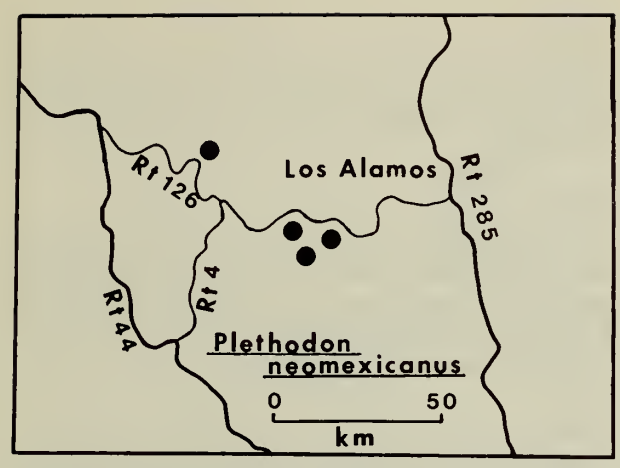


Fig. 29. Distribution of the Jemez Mountains salamander in northern New Mexico.

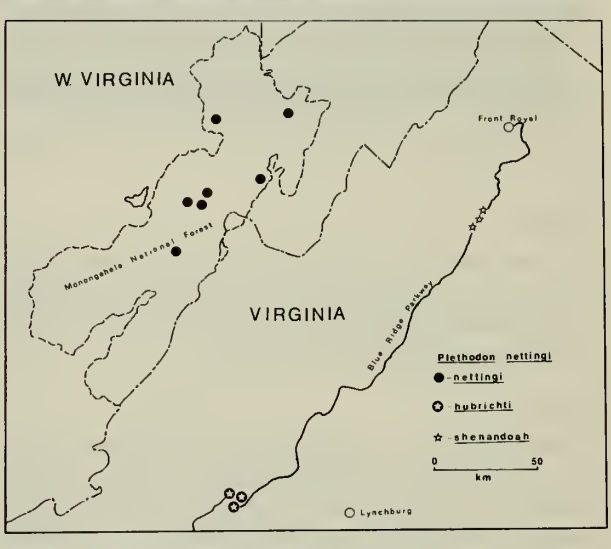


Fig. 30. Adult Peaks of Otter salamander (Photo by C. K. Dodd) and disjunct occurrence of the three subspecies of *P. nettingi.*

Recommendations

- Known populations of this salamander should be protected from logging and commercial development.
- A habitat management plan needs to be developed for this species on Federal lands.

Cheat Mountain Salamander (*Plethodon nettingi nettingi*)

Description

This slender woodland salamander reaches a total length of 11 cm. Adults are brown above with numerous small brassy flecks. The venter is plain gray to black.

Range

This form is known from only seven localities, all above 1,070 m elevation in the Cheat Mountains, Randolph and Pocahontas counties, West Virginia (Highton 1971). Its distribution is shown in Fig. 30.

Habitat

This salamander is always found associated with red spruce, either in pure stands or in mixed conifer-deciduous forests. It is found under logs or moss-covered rocks where the ground is damp. Occasionally it is found among wet leaves. Brooks (1948) reported that this salamander lays its eggs only in the interior of downed red spruce logs.

Status

Seasonally common, but its restriction to spruce forests makes it particularly vulnerable. Monongahela National Forest has developed a habitat management plan for the Cheat Mountain salamander which, if followed, lends protection for this species.

Recommendations

- Protection as outlined in the habitat management plan of the Monongahela National Forest, West Virginia, should be maintained.
- The percentage of red spruce in mixed spruce-hardwood forest should be increased.
- Seeps and wet areas from roads and logging skid trails should be protected.
- Forest thinnings should be done judiciously to prevent invasion of undesirable understory plants.
- Special harvesting measures prescribed for each kind and age class of spruce-hardwood forest should be followed.
- Other areas should be surveyed for the Cheat Mountain salamander.

Peaks of Otter Salamander (*Plethodon nettingi hubrichti*)

Description

A slender woodland salamander that reaches a total length of 13 cm. Dorsally it is a dark brown with abundant brassy metallic spots or blotches that occasionally form an irregular dorsal stripe. The venter is plain dark gray to black.

Range

This species is primarily known from localities along the Blue Ridge Parkway (Fig. 30) between miles 78 and 84 (Bedford, Botetourt, and Rockbridge counties), Virginia (Highton 1971). We have seen individuals about 2 km west of the Parkway.

Habitat

These animals are found primarily under downed logs and among wet leaves in middle to late successional stages of deciduous (oak, maple) woodland at elevations generally above 760 m.

Status

Individuals are seasonally common. Most of the known populations are at least partly within the Blue Ridge Parkway, which is protected as a National Park. However, since the Parkway is only a few hundred meters wide in places, adjoining forest populations are subject to habitat disruption by logging.

Recommendations

- Land adjoining the Parkway containing known populations of this salamander should be protected from logging or commercial development.
- Collecting adjacent to the Parkway should be reduced or stopped if it results in habitat destruction.
- Further study of distribution and abundance is needed.

Shenandoah Salamander (*Plethodon nettingi shenandoah*)

Description

This elongate, slender salamander is black on the sides and belly and has a narrow red stripe down its back. Occasional specimens are completely black. Costal grooves usually number 18. This species closely resembles the common redback salamander (*Plethodon cinereus*); however, the redback salamander normally has a pale belly, 19 costal grooves, and wide dorsal stripe.

Range

This species is known only from three peaks (Hawksbill, Stony Man, and the Pinnacles) in Shenandoah National Park, Madison and Page counties, Virginia (Fig. 30).

Habitat

The species is confined to the talus slopes high on the north and northwest facing peaks, where it lives under rocks and other surface debris. Adults occasionally are found in forest areas within a few hundred meters of the edge of the talus.

Status

This species "is faced with potential extinction due to the erosion of soil into its talus refugium followed by a subsequent encroachment of [*Plethodon*] *cinereus*, and due to the paucity of isolated pockets of soil which are the centers of its distribution" (Jaegar 1970).

The entire range of the species is within Shenandoah National Park; collection is strictly regulated and is only for scientific purposes.

Recommendations

- Maintain prohibitions against collection of specimens for purposes other than scientific study.

Siskiyou Mountains Salamander (*Plethodon stormi*)

Description

This elongate salamander reaches a total length of 15 cm. The dorsal color is dull brown to chocolate brown, with flecks of white; the venter is pale brown or gray.

Range

This species is restricted to the Upper Applegate River basin in Jackson County, southern Oregon, and to the Upper Klamath River basin in extreme northern Siskiyou County, northern California (Brodie 1970). Its distribution is shown in Fig. 31.

Habitat

Frequents rock rubble and talus slopes in heavily wooded areas.

Status

Plethodon stormi was once considered an uncommon salamander, partly because of its recent discovery in a remote region (Highton and Brame 1965). Proposed construction of a dam on the Applegate River by the U.S. Army Corps of Engineers would inundate the

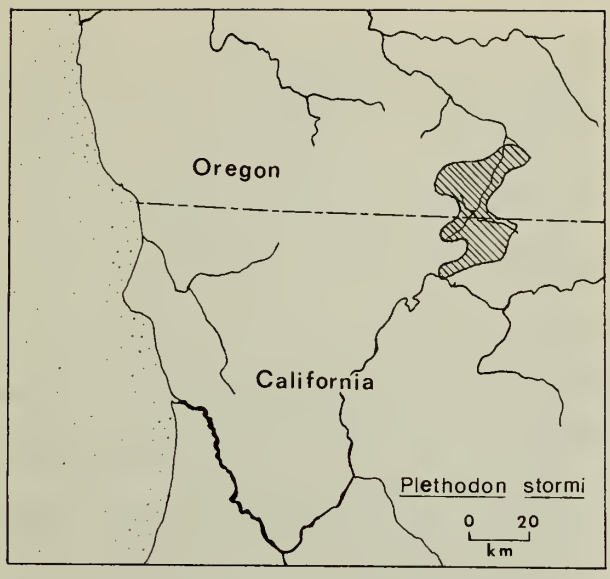


Fig. 31. Range of the Siskiyou Mountains salamander.

area where the salamander was first discovered, as well as areas occupied by several other known populations. Collection, possession, and sale of these animals are prohibited by California law, which recognizes it as a "Rare" species.

Recently, Ronald A. Nussbaum of the University of Michigan located many new localities for the salamander in the Applegate River basin, where it is locally abundant. Bury (1973) suggested that *P. stormi* is not a valid species but is an isolate of *P. elongatus*, a related form which is now known to occur nearby, in the Upper Klamath River basin.

Recommendations

- The relationships of *P. stormi* to *P. elongatus* needs to be better defined.
- The habitat of the Siskiyou Mountain salamander should be protected through habitat management plans of the U.S. Forest Service in the region.
- The limited habitat of this salamander should be spared from clear-cut logging.
- The species should be considered as an animal of special concern but not as a threatened form.

Texas Blind Salamander (*Typhlomolge rathbuni*) (=*Eurycea rathbuni*)

Description

This pale, neotenic salamander is unique in form, having very thin, weak legs and red or pink gills. It has

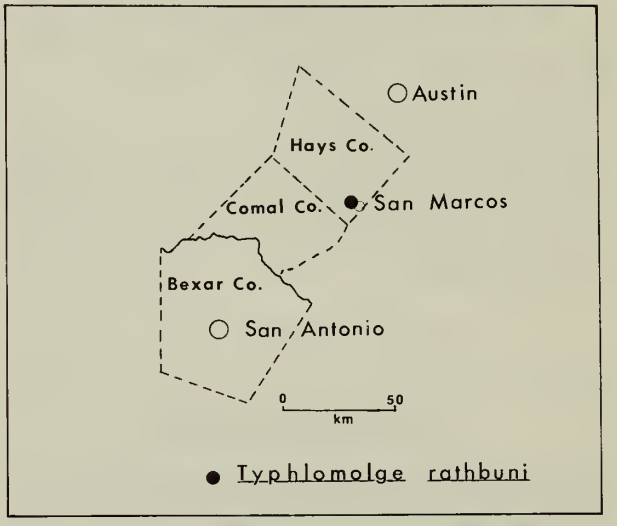


Fig. 32. Adult Texas blind salamander and its local isolation in south central Texas. (Photo by G. Longley)

a greatly flattened snout and small dark eye spots. Adults reach a total length of 13 cm.

Range

This species is historically known from seven localities in the vicinity of San Marcos, Hays County, Texas (Fig. 32), but some of the historical localities no longer support populations of the salamander. Populations are now known to survive in several other sites near San Marcos (for details see Russell 1976 and Longley 1978).

Habitat

This form lives in underground streams and aquifers. Specimens occasionally come to the surface in wells and springs (G. Longley, personal communication).

Status

Populations of this salamander generally appear to be stable (Longley 1978), although in some caves salamanders are apparently becoming scarcer.

This species is protected in Ezell's Cave by the Nature Conservancy and is listed as Endangered by the USDI (1973). Texas lists this species as "Threatened."

Recommendations

- Protection of Ezell's Cave by the Nature Conservancy, Inc., should be maintained; however, it should be recognized that more abundant populations at other sites need attention.
- As few impurities as possible should be allowed to enter the water systems around the caves where this salamander occurs. Pumping of groundwater in the vicinity of these caves should be discouraged.
- Since these organisms do not survive in surface waters because they are preyed upon by fish or die from other causes, washed up specimens should be salvaged for scientific investigations.
- Critical habitat should be determined for the extant populations.

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